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the ACCOUNTING REVIEW

Quarterly Journal of the
AMERICAN ACCOUNTING ASSOCIATION

7

MAIN ARTICLES

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Uses of Indexes and Data Bases for Information Release Analysis
Charlotte J. Wright and James E. Groff

JANUARY 1986

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Information Asymmetry, Incentive Schemes, and Information Biasing: The Case of Hospital Budgeting Under Rate Regulation

Garth A. Blanchard, Chee W. Chow and Eric Noreen

ABSTRACT: Revenues of hospitals in the state of Washington are constrained by an upper bound that is a function of budgeted costs, budgeted volume, and actual volume. Basically, allowable revenue is the hospital's total budgeted cost, with an adjustment for the difference between actual and budgeted volume. A hospital can increase its allowable revenue by biasing the budget data reported to the Washington State Hospital Commission. For example, when a hospital budgets for an increase in volume, it is to the hospital's advantage to overstate the impact of the increase in volume on the hospital's total budgeted cost. Conversely, when a hospital budgets for a decrease in volume, the constraint on revenues can be relaxed by understating the impact of the decrease in volume on the hospital's total budgeted cost. Empirical evidence is consistent with hospitals biasing, in certain predictable ways, budget data reported to the regulatory commission.

This study examines the budgeting behavior of hospitals that are subject to revenue regulation in the state of Washington. This investigation has three objectives: first, to explore some of the reporting issues that result when a particular form of revenue regulation is employed; second, to provide evidence concerning how incentive schemes may affect the accuracy of information transmitted across hierarchical levels; and third, to test implications of agency theory in a regulatory environment.

The need for hospital cost containment has been a much voiced concern in recent years [Bauer, 1977; Weinberger, 1981; Johnson and Johnson, 1982].[1] The state of Washington has responded to this concern by attempting to regulate the revenues that can be earned by hospitals operating within its borders. The issues explored in this paper have implications

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[1] A manifestation of the concern with hospital costs is the Medicare program's switch to preset reimbursement rates based upon diagnostically related groups.

We are indebted to the Washington State Hospital Commission for making available the data for this study. Helpful comments were received from Bill Kinney, two anonymous reviewers, and accounting workshop participants at the University of Washington and the University of North Carolina at Chapel Hill, especially Gary Biddle, Ed Blocher, David Burgstahler, Bill Felix, Jr., Roann Kopel, Jim Jiambalvo, Glenn Pfeiffer, and Rebecca Todd.

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TABLE 1

HOSPITAL BUDGETS: REQUESTED AND APPROVED

Fiscal Year	*Requested By Hospitals*	*Approved By Commission*	*Difference*	*Difference as a % of Requested*
1977	$ 726,682,231	$ 719,358,737	$ 7,323,494	1.0
1978	795,106,882	772,958,819	22,148,063	2.8
1979	891,139,413	858,191,381	32,948,032	3.7
1980	1,070,508,330	1,056,474,658	14,033,672	1.3
1981	1,385,291,542	1,350,343,482	34,948,060	2.5
1982	1,712,666,659	1,674,911,433	37,755,226	2.2
1983	1,946,704,988	1,914,079,051	32,625,937	1.7

for similar hospital containment programs elsewhere in the country. Further, to the extent similar revenue regulations exist in other industries (e.g., public utilities), the issues explored here may apply to those industries as well.

At a more general level, the regulator-regulatee relationship is a form of principal-agent relationship. Thus far, empirical tests of agency theory in accounting research have concentrated on financial accounting issues, such as firms' lobbying behavior regarding proposed accounting standards [Watts and Zimmerman, 1978], choice of accounting methods [Zmijewski and Hagerman, 1981; Bowen, Noreen and Lacey, 1981; Lilien and Pastena, 1982], voluntary hiring of external auditors [Chow, 1982], switches in auditors [DeAngelo, 1982], and the cross-sectional wealth impacts of accounting regulations [Leftwich, 1981; Collins, Rozeff and Dhaliwal, 1981; Chow, 1983]. However, in a study that has special relevance here, Jarrell [1979] presents evidence that utilities responded to the introduction of rate-of-return regulation between 1917 and 1922 by inflating their reported asset values (and hence their rate bases). In this study, we present evidence that hospitals have responded to revenue regulation by biasing budgetary forecasts in ways that relax the constraints on allowable revenue.

The remainder of this paper is organized as follows: The mechanics of hospital revenue regulation in Washington State are described in the next section. Then, hypotheses concerning hospital budgeting behavior (information biasing) under this regulation are derived. Next, the empirical results are presented, followed by the conclusions.

THE MECHANICS OF REVENUE REGULATION IN WASHINGTON STATE

Beginning with fiscal year 1976, the Washington State Hospital Commission (WSHC) was charged with assuring that "total hospital costs are reasonably related to total services and hospital rates are reasonably related to aggregate costs . . ." [Chapter 70.39 of the Revised Code of Washington].

Each hospital subject to the regulatory authority of the WSHC (112 hospitals in 1983) is required to submit a budget at least 75 days before the beginning of its next fiscal year. The budget includes projected operating and capital requirements and, in the case of for-profit hospitals, a profit allowance. Each budget request is reviewed by the Commission staff and a public hearing is held before the Commission prior to the Commission's final action on the request. Table 1 summarizes the aggregate requests from hospitals, the amounts authorized by the Commission, and the difference between hospital requests and amounts authorized.

This authorized budget, adjusted for deviations between actual and budgeted volume, sets a lid on the revenue that can be earned by the hospital. The budget is adjusted for the deviation between actual and budgeted volume by assuming variable costs are either 20, 30, or 40 percent of total budgeted costs, depending upon the characteristics of the hospital. If the volume-adjusted budget exceeds the hospital's actual total revenue, the hospital is considered to be in conformance and no further action is taken.

If, however, the hospital's actual revenue exceeds the volume-adjusted budget, a similar analysis is carried out for each revenue center. The budget for each revenue center is adjusted for actual volume by assuming that variable costs are either 20, 30, or 40 percent—depending upon the characteristics of the hospital—of the total costs of the revenue center. The sum of volume-adjusted budgets for the revenue centers is then compared to the total revenue of the hospital. The Year End Conformance Adjustment (YECA) is the lesser of the excess revenue determined using the total budget method or the revenue center method. If the YECA is positive, it is deducted from the succeeding year's budget, unless an amendment is requested by the hospital and approved by the Commission.[2]

Descriptive statistics concerning the Year End Conformance Adjustments are presented in Table 2. (There were no Year End Conformance Adjustments for fiscal years 1976 and 1977, which were considered experimental years in the regulatory process.) There were a total of 83 Year End Conformance Adjustments between 1978 and 1982 out of a total of 538 hospital-years, or on average, 15.4 percent of the hospitals in a year face a YECA. Through the amendment process, however, 48 of these YECA were forgiven by the Commission. The largest single YECA has been 5.61 percent of revenues, which was charged against a hospital as a result of its 1979 operations.

INCENTIVES TO BIAS REPORTED BUDGETS

Assume hospital *h*'s actual cost and volume relationship is

$$TC^a_{ht} = F^a_{ht} + v^a_{ht} q^a_{ht} \tag{1}$$

where

TC^a_{ht} = hospital *h*'s actual total cost for period *t*,
F^a_{ht} = hospital *h*'s actual total fixed cost for period *t*,
v^a_{ht} = hospital *h*'s actual variable cost per unit for period *t*, and
q^a_{ht} = hospital *h*'s actual volume for period *t* measured by Adjusted Patient Days (APDS).[3]

We assume the hospital knows the parameters of this flexible budget, including the actual volume, at the beginning of the year.[4] We assume, however, that the

---

[2] Since hospital rates are not directly regulated, it is not clear what the ultimate weapon is in the WSHC armory. Narrowly, the consequence of a YECA is simply that the next year's YECA would be larger. It is doubtful, however, that a hospital could indefinitely simply "roll-over" its YECA with impunity. The Commission can impose substantial costs on nonconforming hospitals by means other than dictating rates.

[3] Adjusted Patient Days is the volume measure used by the WSHC and is computed as follows: Hospital patients are classified into two types: inpatients and outpatients. Since inpatients occupy beds in the hospital, inpatient days are calculated directly as the total number of admitted days. Outpatient volume, such as patients using the emergency room or clinical services, is converted into equivalent inpatient days. First, inpatient revenue is divided by inpatient days to yield an average revenue per inpatient day. Outpatient revenue is then divided by the average daily inpatient revenue. This yields the equivalent number of inpatient days represented in outpatient revenue. The sum of inpatient and equivalent outpatient days is the number of adjusted patient days.

[4] Alternatively, we could assume that the hospital has available an unbiased estimate of the volume for the

TABLE 2

DESCRIPTIVE STATISTICS CONCERNING YEAR END CONFORMANCE ADJUSTMENTS (YECA)

	78	*79*	*80*	*81*	*82*	*Total*
1. Number of Hospitals						
1.1 In the data base	110	111	110	107	100	538
1.2 With Year End Conformance Adjustments						
1.2.1 Before approval of amendments to YECA	5	15	16	26	21	83
1.2.2 After approval of amendments to YECA	0	10	6	9	10	35
2. Year End Conformance Adjustment as a percentage of approved rate setting revenue*						
2.1 Before approval of amendments to YECA						
2.1.1 Minimum	.39%	.14%	.07%	.01%	.05%	.01%
2.1.2 Maximum	4.34%	5.61%	2.70%	7.35%	1.78%	7.35%
2.1.3 Mean	1.31%	1.60%	.86%	1.41%	.74%	1.16%
2.2 After approval of amendments to YECA						
2.2.1 Minimum		.53%	.13%	.01%	.07%	.01%
2.2.2 Maximum		5.61%	1.93%	3.14%	1.47%	5.61%
2.2.3 Mean		1.77%	.75%	.87%	.67%	1.05%

* Only hospitals with a non-zero Year End Conformance Adjustment are included in the statistics in Panel 2.

WSHC does not know these parameters and only discovers the actual volume and actual total cost at the end of the year.

While the budget submitted to the WSHC does not differentiate explicitly between fixed and variable costs, assume the budget is constructed by the hospital using a flexible budget described by

$$TC^b_{ht} = F^b_{ht} + v^b_{ht} q^b_{ht} \tag{2}$$

where the superscript b refers to budgeted, rather than actual, amounts.

At the end of the period, the hospital's allowable revenue, denoted by AR_{ht}, is determined by adjusting the budget for actual volume as follows:

$$AR_{ht} = TC^b_{ht} + avc_{ht}(q^a_{ht} - q^b_{ht}) \tag{3}$$

where

AR_{ht} = the allowable revenue for hospital h in period t, and

avc_{ht} = the WSHC estimated unit variable cost for hospital h in period t.

The WSHC estimates a hospital's unit variable cost using the following definition:

$$avc_{ht} \equiv \frac{vcr_{ht} TC^b_{ht}}{q^b_{ht}}$$

where

vcr_{ht} = the assumed variable cost ratio (i.e., total variable cost divided by total cost) for hospital h in period t.

A hospital's assumed variable cost ratio depends upon which of the six "Peer Groups" the hospital has been assigned to by the WSHC. The WSHC classification process, which uses cluster analysis, is based upon six variables: number of available beds, scope of service index, average number of residents, number of physician specialties, percent Medicare patient days, and percent urban population. For example, Peer Group 1 consists of smaller hospitals in sparsely populated areas of the state and Peer Group 6 consists of major research hospitals located in urban areas. The assumed variable cost ratio, vcr_{ht}, is 20 percent for WSHC Peer Groups 1 and 2; 30 percent for Peer Groups 3 and 4; and 40 percent for Peer Groups 5 and 6.

If allowable revenue, as defined in equation 3, exceeds the hospital's actual total revenue, the hospital is considered to be in compliance. If, however, the hospital's actual total revenue exceeds the allowable revenue, a similar analysis is conducted by revenue centers. Even though this analysis by revenue centers may result in no YECA, it would seem prudent for the hospital to arrange matters so that its allowable revenue, computed using equation 3, is high enough for the hospital to escape further regulatory scrutiny.

Taking the first partial derivative of the allowable revenue, AR_{ht}, with respect to budgeted volume, q^b_{ht}, and evaluating the result at the point at which budgeted volume equals actual volume yields

$$\left.\frac{\partial AR_{ht}}{\partial q^b_{ht}}\right|_{q^b_{ht}=q^a_{ht}} \tag{4}$$

$$= v^b_{ht} - vcr_{ht} \times \frac{(F^b_{ht} + v^b_{ht} q^a_{ht})}{q^a_{ht}}$$

This partial derivative is positive if, and only if,

$$\frac{v^b_{ht} q^a_{ht}}{F^b_{ht} + v^b_{ht} q^a_{ht}} > vcr_{ht} \tag{5}$$

The quantity on the left-hand side in equation 5 is the budgeted variable cost ratio, evaluated at the actual volume.

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forthcoming year. Providing that the hospital desires to maximize its expected allowable revenue, the analysis would proceed unchanged. The only difference would be in the interpretation of the empirical tests. The actual volume then would have to be considered a surrogate for expected volume.

Equation 4 implies that if this budgeted variable cost ratio exceeds the variable cost ratio assumed by the WSHC in its end-of-year adjustments, the allowable revenue constraint can be relaxed by overestimating volume in the budget. Conversely, if the hospital's budgeted variable cost ratio is less than the ratio assumed by the Commission, the allowable revenue can be increased by underestimating volume.

The reason for this is that the variable cost ratio on the left-hand side of equation 5 is implicitly the variable cost ratio allowed by the WSHC in the hospital's budget, whereas the volume adjustment at the end of the year assumes the variable cost ratio is vcr_{ht}. If the implicit variable cost ratio exceeds vcr_{ht} and the hospital overestimates its volume (thus expecting a negative volume variance), then the allowable revenue in the original budget expands by the higher implicit rate while the anticipated negative volume variance in the year-end adjustment reduces the allowable revenue by the lower vcr_{ht}. Thus, overestimating volume leads to an overall net increase in the total revenue the hospital is allowed. A parallel analysis can be made for underestimating volume when the implicit variable cost ratio is less than vcr_{ht}.

In addition to the volume forecast, allowable revenue depends on the chosen values for F^b_{ht} and v^b_{ht}. Clearly, if no constraint were imposed, it would be in the hospital's interests to overestimate both of these costs without bounds. However, the flexible budget must be believable, at least within the context of the previous year's actual results. This constraint can be expressed as

$$F^b_{ht} + v^b_{ht} q^a_{h\,t-1} = TC^a_{h\,t-1} \tag{6}$$

Since both $q^a_{h\,t-1}$ and $TC^a_{h\,t-1}$ are known to the regulator, equation 6 forces the hospital to trade-off F^b_{ht} and v^b_{ht}.

Taking the first partial derivative of allowable revenue with respect to budgeted unit variable costs and recognizing the constraint, equation 6 yields

$$\frac{\partial AR_{ht}}{\partial v^b_{ht}} = \left(\frac{q^b_{ht} - q^a_{h\,t-1}}{q^b_{ht}}\right) \times ((1 - vcr_{ht}) q^b_{ht} + vcr_{ht} q^a_{ht}) \tag{7}$$

Since q^b_{ht} and $(1 - vcr_{ht}) q^b_{ht} + vcr_{ht} q^a_{ht}$ are positive, equation 7 is positive if and only if $q^b_{ht} > q^a_{h\,t-1}$.

$$\frac{\partial AR_{ht}}{\partial v^b_{ht}} > 0 \text{ iff } q^b_{ht} > q^a_{h\,t-1}. \tag{8}$$

In other words, if a hospital is budgeting for an increase in volume over the previous year, the hospital will be inclined to inflate its estimate of the impact of the increase in volume on the hospital's costs. Similarly, if a hospital is budgeting for a decrease in volume over the previous year, the hospital will tend to down-play the impact of that decrease in volume on the hospital's costs.

As an interesting aside, suppose the WSHC's assumed variable cost ratio vcr_{ht} is precisely correct (i.e., $vcr_{ht} = v^a_{ht} q^a_{ht} / TC^a_{ht}$). Then allowable revenue is *minimized* when the hospital reports honestly (i.e., $q^b_{ht} = q^a_{ht}, F^b_{ht} = F^a_{ht}, v^b_{ht} = v^a_{ht}$). This is decidedly *not* a truth-inducing incentive scheme.

In summary, incentives exist under the form of hospital rate regulation used in Washington State for hospitals to bias budgetary data in predictable ways. When volume is increasing (decreasing), hospitals will inflate (deflate) estimates of variable costs. When the budgeted variable cost ratio exceeds (is less than) the variable cost ratio assumed by the WSHC in the end-of-year adjustments to allowable revenue, hospitals will over- (under-) estimate volume.

EMPIRICAL TESTS

The data for the tests that follow were supplied in computer-readable form by the WSHC. A total of 116 hospitals is included in the data base, which covers fiscal years 1976 through 1983. Not every hospital is present in the data base every year. Some new hospitals were started during this period, others were merged, and some were removed from the regulatory environment described above. All tests use all available data.

To increase the power of the tests, it is desirable to pool observations across time. However, the hypotheses are concerned with the relationships between costs and volume, yet changes in costs from one period to the next reflect changes in both volume *and* input prices. Therefore, it is necessary to adjust dollar amounts to reflect inflation in hospital costs. We assume that a hospital's budgeted cost for a year equals the budgeted cost from the previous year, adjusted for any anticipated change in volume and for general inflation in hospital costs:

$$\begin{aligned} TC^b_{ht} = {} & (1+i_t) \times (TC^b_{h\,t-1} \\ & + v^b_{h\,t-1} \times (q^b_{ht} - q^b_{h\,t-1})) \end{aligned} \tag{9}$$

We assume the inflation rate, i_t, is the same for all hospitals in the state in a given year.[5] The values of the variables TC^b_{ht}, $TC^b_{h\,t-1}$, q^b_{ht}, and $q^b_{h\,t-1}$ are known, but the values of the variables i_t and $v^b_{h\,t-1}$ must be estimated. To do this, we impose the additional assumption that the variable cost per unit in a given year is the same for all hospitals that have the same WSHC assumed variable cost ratio. With this restriction, equation 9 can be restated in a form that permits ordinary least-squares estimation of the inflation rate and unit variable costs.

$$\begin{aligned} TC^b_{h\,t-1} = {} & \left(\frac{1}{1+i_t}\right) TC^b_{ht} + \sum_{g\in G} \delta(vcr_{ht} = g) \\ & \times v^b_{g\,t-1} \times (q^b_{h\,t-1} - q^b_{ht}) + \xi_{ht} \end{aligned} \tag{10}$$

where

G = the set of WSHC assumed variable cost ratios (i.e., {.2, .3, .4}),
$\delta(P)$ = {1 if P is true, 0 otherwise},
$v^b_{g\,t-1}$ = budgeted unit variable cost for WSHC group g in period $t-1$, and
ξ_{ht} = error term.

This regression can be estimated separately for each year, yielding estimates of i_t and $v^b_{g\,t-1}$. However, equation 10 essentially assumes that fixed costs are the same in years t and t-1. While it is impossible to assure that fixed costs have not, in fact, changed, we did eliminate in the regression all cases in which the beds available changed between year $t-1$ and year t.[6] The results of these regressions appear in Table 3.

The estimates of i_t using this regression approach are compared in Table 4 to estimates based upon the increase in average cost per APDS from one year to the next for the entire sample. The estimated inflation rates are quite similar using either approach. Nevertheless, the inflation rates based upon the rate of increase in average cost per APDS confound changes in cost due to changes in volume with changes due to changes in input prices. For that reason, all dollar amounts used in subse-

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[5] It could be argued that we should have controlled for differential inflation rates between, say, urban and rural hospitals or between teaching and non-teaching hospitals. Since the WSHC peer groups already reflect such differences between hospitals, we could have proceeded by simply estimating a unique inflation rate and variable cost for each peer group in each year. However, there is a small sample size problem. For example, peer groups 5 and 6 together have as few as six observations in any given year.

[6] There may be an increase in fixed costs even if there is no change in beds available. The empirical problem is to find other observable signals (other than in a change in beds available) that would indicate a change in fixed costs. One possible signal would be changes in medical staff. However, a budgeted change in medical staff may not imply a significant shift in fixed costs. Anecdotes from health care managers suggest to us that in many institutions, at the margin, medical staff costs are much like a variable cost. Hospital administrators have become quick to adjust staffing levels to actual demand.

TABLE 3
ESTIMATING THE HOSPITAL COST INFLATION RATE
(SIGNIFICANCE LEVELS IN PARENTHESES)

Year	Number of Hospitals*	$1/(1+i_t)$	$v^+_{g\,t-1}$ .2 group	$v^+_{g\,t-1}$ .3 group	$v^+_{g\,t-1}$ .4 group	adj R^2
1977	57	.884	73.69	69.67	379.15	.998
		(.000)	(.100)	(.001)	(.001)	(.000)
1978	71	.901	77.01	111.06	180.12	.999
		(.000)	(.001)	(.002)	(.000)	(.000)
1979	79	.920	105.45	130.27	46.754	.999
		(.000)	(.018)	(.066)	(.023)	(.000)
1980	76	.851	109.32	173.93	115.87	.997
		(.000)	(.022)	(.005)	(.000)	(.000)
1981	72	.856	130.20	197.41	448.73	.998
		(.000)	(.203)	(.073)	(.000)	(.000)
1982	75	.864	160.34	160.44	522.17	.999
		(.000)	(.006)	(.072)	(.000)	(.000)
1983	65	.893	170.52	206.24	379.11	.999
		(.000)	(.225)	(.000)	(.000)	(.000)

* A hospital is included in a year t if:
1) it is in WSHC peer groups 1 through 6,
2) the following data are available: $TC^b_{h\,t-1}$, TC^b_{ht}, $q^b_{h\,t-1}$, q^b_{ht},
and 3) there was no change in the number of beds available during the year.

quent tests are restated to a 1976 basis using the price index constructed from the results of regression equation 10.

The Relationship Between Budgeted Changes in Volume and Budgeted Variable Costs

In the previous section we argued that a hospital which budgets for an increase (decrease) in volume will tend to inflate (deflate) its budgeted unit variable costs. This hypothesis is tested using the following regression model:

$$\left(\frac{TC^b_{ht}}{HCI_t} - \frac{TC^b_{h\,t-1}}{HCI_{t-1}}\right) = \sum_{g\in G} \delta(vcr_{ht}=g) \times [\alpha_g \times (q^b_{ht}-q^b_{h\,t-1}) + \delta(q^b_{ht} > q^b_{h\,t-1}) \times \alpha^+_g \times (q^b_{ht}-q^b_{h\,t-1})] + \xi_{ht} \qquad (11)$$

where

HCI_t = the hospital cost index for period t,
α_g and α^+_g = coefficients, and
ξ_{ht} = the error term.

The left-hand side of equation 11 is the change in hospital cost-level-adjusted total budgeted cost. There are six independent variables on the right-hand side with coefficients $\alpha_{.20}$, $\alpha^+_{.20}$, $\alpha_{.30}$, $\alpha^+_{.30}$, $\alpha_{.40}$, $\alpha^+_{.40}$. The first independent variable, with the coefficient $\alpha_{.20}$, equals the change in budgeted volume when the hospital's WSHC assumed variable cost ratio is .20; otherwise, the first independent variable is zero. The second independent variable, with the coefficient $\alpha^+_{.20}$, equals the change in budgeted volume when the hos-

TABLE 4

ESTIMATED HOSPITAL COST INFLATION RATES

	1977	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*
Yearly rate of change							
Regression Approach (See Table 3)	13.2%	11.0%	8.7%	17.5%	16.8%	15.7%	12.0%
Average Budgeted Cost Per Budgeted APDS	14.0%	9.4%	9.4%	15.7%	17.7%	16.0%	13.0%
Index (1976 = 100)							
Regression Approach	113.2	125.6	136.5	160.5	187.4	217.0	243.0
Average Budgeted Cost Per Budgeted APDS	114.0	124.7	136.4	157.8	185.6	217.5	245.8

pital's WSHC assumed variable cost ratio is .20 *and* the hospital has budgeted for an increase in volume over the previous period's actual volume; otherwise, it is zero. Therefore, the coefficient on the first variable, $\alpha_{.20}$, is an estimate of the budgeted unit variable cost when budgeted volume is declining and the coefficient on the second variable plus the coefficient on the first variable, $\alpha_{.20}+\alpha^{+}_{.20}$, is an estimate of the budgeted unit variable cost when budgeted volume is increasing.

Formally, the hypothesis can be stated as

$$H_1:\ \alpha_g+\alpha_g^{+}>\alpha_g,\ \text{or}\ \alpha_g^{+}>0\ \text{for all}\ g\epsilon G.$$

Therefore, the statistical significance of the second coefficient in equation 11, $\alpha^{+}_{.20}$, provides a convenient test of the hypothesis that the budgeted unit variable costs differ between the case where volume is increasing and the case where volume is decreasing for hospitals with a WSHC assumed variable cost ratio of .20. The third and fourth coefficients relate to the .30 WSHC group and the fifth and sixth coefficients relate to the .40 WSHC group.

The results of this cross-sectional and time-series regression appear in Table 5. As before, a hospital is excluded in a given year if there is a change in beds during the year. Panel 1 of Table 5 provides a descriptive classification of the observations by WSHC group and change in volume. While most hospitals budget for an increase in volume, about 26 percent of the observations involve budgeting for a decrease in volume.

Panel 2 of Table 5 contains the results of regression equation 11. While one of the six coefficients is not significant and one is only marginally significant, the results are broadly consistent with the hypothesis. The budgeted unit variable costs *are* higher when volume is increasing than when it is decreasing (i.e., $\alpha_g^{+}>0$). As a further test, we constrained α_g^{+} to be the same for all three WSHC groups. The results of this regression are reported in Panel 3 of Table 5. Adding this constraint results in a regression in which all coefficients are significantly different from zero. And, once again, the results are consistent with the hypothesis.

While these results are consistent with the hypothesis, they are also consistent with another hypothesis. Namely, fixed costs could follow a ratchet function. That is, fixed costs are added in steps as

TABLE 5

TESTS OF H_1

Panel 1. Descriptive Classification of Observations

Relationship between currently budgeted volume and previous actual volume	WSHC assumed variable cost ratio			
	$vcr_{ht}=.2$	$vcr_{ht}=.3$	$vcr_{ht}=.4$	Totals
$q^b_{ht}>q^a_{h,t-1}$	153	123	37	313
$q^b_{ht}<q^a_{h,t-1}$	78	24	10	112
	231	147	47	425

Panel 2. Unconstrained Test

$$\left(\frac{TC^b_{ht}}{HCI_t}-\frac{TC^a_{h,t-1}}{HCI_{t-1}}\right)=\sum_{g\in G}\delta(vcr_{ht}=g)\times[\alpha_g\times(q^b_{ht}-q^a_{h,t-1})+\delta(q^b_{ht}>q^a_{h,t-1})\times\alpha^+_g\times(q^b_{ht}-q^a_{h,t-1})]+\xi_{ht} \qquad (11)$$

	$vcr_{ht}=.2$		$vcr_{ht}=.3$		$vcr_{ht}=.4$		
	α_g	α^+_g	α_g	α^+_g	α_g	α^+_g	adj R^2
coefficient	34.97	58.96	43.93	59.74	79.96	70.21	.478
one-tailed significance	.191	.010	.027	.102	.003	.051	.000

Panel 3. Constrained Test

$$\left(\frac{TC^b_{ht}}{HCI_t}-\frac{TC^a_{h,t-1}}{HCI_{t-1}}\right)=\sum_{g\in G}\delta(vcr_{ht}=g)\times[\alpha_g\times(q^b_{ht}-q^a_{h,t-1})+\delta(q^b_{ht}>q^a_{h,t-1})\times\alpha^+\times(q^b_{ht}-q^a_{h,t-1})]+\xi_{ht}$$

	α_g				
	$vcr_{ht}=.2$	$vcr_{ht}=.3$	$vcr_{ht}=.4$	α^+	adj R_2
coefficient	33.24	42.58	87.99	61.29	.480
one-tailed significance	.082	.004	.000	.000	.000

volume increases but they are not reduced when the volume declines. If this were true, then the increased fixed costs would be picked up in the regression as part of the estimated unit variable costs when volume is increasing, but will be captured in the fixed cost component when volume declines. Under these conditions, the estimated unit variable costs when volume is contracting will naturally be lower than when volume is expanding. We have attempted to control for changes in fixed costs by including in the regressions only years in which there were no changes in the number of beds available, a capacity variable. Nevertheless, we cannot rule out the explanation that the apparent increase in budgeted unit variable costs when volume is expanding is simply an artifact of adding other types of fixed costs that are not a function of the number of beds available.

Biasing Volume Forecasts

We hypothesized that if a hospital's budgeted variable cost ratio exceeds (is less than) the WSHC assumed variable cost ratio used in the end-of-year adjustments, it is in the hospital's interests to over- (under-) estimate its volume for the forthcoming year. To test this hypothesis, we use the coefficients estimated in the last section to estimate each hospital's budgeted unit variable costs in each year. A hospital's unit variable costs in this scheme can take on any one of six possible values in a given year. There are three groups and within each group, an estimated unit variable cost for hospitals forecasting expansion and an estimated unit variable cost for hospitals forecasting contraction. These estimated budgeted unit variable costs are displayed in Panel 1 of Table 6.

It is likely that these unit variable costs are overstated since the change in fixed costs, which doubtless is positively correlated with the change in volume, is an omitted variable in regression equation 10. The hypothesis in this section is sensitive to the levels of estimated budgeted unit variable costs since a hospital's volume forecasting behavior is predicted to hinge on the relationship between its budgeted variable cost ratio and the variable cost ratio the WSHC uses in its end-of-year adjustments. If all of our estimates of budgeted unit variable costs are overstated, we may well predict (incorrectly) that all hospitals will overestimate their volume.

For purposes of the tests in this section, we assume that all of the constant dollar estimated budgeted unit variable costs, $\frac{\hat{v}^b_{ht}}{HCI_t}$ in Panel 1 of Table 6, are overstated by the same amount x.

$$\frac{\hat{v}^b_{ht}}{HCI_t} = \frac{v^b_{ht}}{HCI_t} + x \tag{12}$$

where

$\hat{v}^b_{ht}$ = the estimated budget unit variable cost,
v^b_{ht} = the real (unknown) budgeted unit variable cost, and
x = the amount by which all estimates of v^b_{ht} are upwardly biased.

The hypothesis tested in this section is that a hospital will overestimate its volume (i.e., $q^b_{ht} > q^a_{ht}$) if and only if

$$\frac{v^b_{ht} q^a_{ht}}{F^b_{ht} + v^b_{ht} q^a_{ht}} > vcr_{ht} \tag{5}$$

The values of q^a_{ht} and vcr_{ht} are known, but the values of v^b_{ht} and of F^b_{ht} must be estimated. Replacing F^b_{ht} with $TC^b_{ht} - v^b_{ht} q^b_{ht}$ and v^b_{ht} by $\hat{v}^b_{ht} - x\, HCI_t$ in equation 5, and rearranging terms to isolate x, results in the following condition which is equivalent to equation 5:

$$D_{ht} \equiv \frac{\hat{v}^b_{ht}}{HCI_t} - \frac{vcr_{ht} \dfrac{TC^b_{ht}}{HCI_t}}{(1 - vcr_{ht}) \times q^a_{ht} + (vcr_{ht}) \times q^b_{ht}} > x \tag{13}$$

That is, a hospital will overestimate volume if and only if inequality (13) holds. All of the values on the left-hand side of equation 13 are observable and hence the value of the left-hand side, D_{ht}, can be computed for each hospital in each year (providing data are not missing). We don't know what the critical value x is, but above that value, hospitals should overestimate volume and below that value, hospitals should underestimate volume.

Defining the forecast error to be

$$FE_{ht} \equiv q^b_{ht} - q^a_{ht}, \tag{14}$$

the hypothesis can be stated succinctly as

H₂: Prob (FE_{ht} and $D_{ht} - x$ have the same signs) >

Prob (FE_{ht} and $D_{ht}-x$ have opposite signs)

The values of FE_{ht} and D_{ht} were computed for each hospital in each year from 1978 through 1982 (providing data were available).[7] The observations were pooled across time and across hospitals and the value of the cut-off score x was selected that minimized the number of misclassified observations. The results of this process are reported in Panel 12 of Table 6. The value of x that maximized the apparent consistency of the data with H2 was 8.57, which resulted in misclassification of 149 out of 491 observations. In terms of H_2, the relative frequency with which FE_{ht} and $D_{ht}-x$ have the same signs is 69.7 percent. Taken by themselves, these results are misleading, since x was purposely selected to maximize the apparent consistency of the data with the hypothesis.

The statistical significance of the results was assessed in the following way. The null hypothesis implicitly is that the signs of FE_{ht} and $D_{ht}-x$ are independent. Therefore, the distribution of the number of misclassifications under the null can be assessed by randomly shuffling the vector of forecast errors relative to the vector of D_{ht} scores. Once this is done, the value of x that minimizes the number of miscalculations can be determined for the random assignment of forecast errors to D_{ht} scores. And, associated with this x is the minimum number of misclassifications under H_2. In other words, even though the data are shuffled so that the null hypothesis is definitionally true, we select a cut-off x that maximizes the apparent consistency of the data with H_2—just as we did with the unshuffled data. If this process is repeated, the distribution of the minimum number of misclassifications can be generated. We did this 1000 times; that is, we shuffled the data 1000 times and for each of the 1000 times, we selected the cut-off x to minimize the number of misclassifications under H_2.[8]

The empirical distribution of the number of misclassifications under the null hypothesis is presented in Panel 3 of Table 6. In 1000 trials, the smallest number of misclassifications was 156, while the number of misclassifications for the unshuffled data was 149.[9] Therefore, the data are consistent with the hypothesis that hospitals over- (under-) estimate volume when the budgeted variable cost ratio exceeds the WSHC assumed variable cost ratio that is used in end-of-year adjustments.

While we doubt that the assumptions of the t-test are satisfied, a t-test of the difference in the mean D_{ht} scores between observations with positive and negative forecast errors was conducted and its result is displayed in Panel 4 of Table 6. As predicted, the mean D_{ht} for the positive forecast group exceeded the mean D_{ht} for the negative forecast group, and the nominal significance level of the difference in the means is .001.

An Alternative Hypothesis

The evidence presented so far is consistent with both H_1 and H_2. However, as previously discussed, the results of the tests of H_1 are also consistent with the hypothesis that additional fixed costs are incurred when volume increases and that

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[7] The year 1983 was excluded since computation of FE_{ht} for 1983 requires knowledge of actual volume, q^a_{ht}, for 1983. These data were not available.

[8] Actually, the process was slightly more complex. We shuffled the vector of forecast errors relative to the vector of D_{ht} scores *within* each year. We did this because we suspect the distributions of the forecast errors and D_{ht} scores differ between years.

[9] The number of misclassifications can never exceed 165, which is the number of negative forecast errors in the sample. A cut-off score x can always be chosen to be less than the minimum value of D_{ht}, which would result in predicting a positive forecast error for every hospital in every year. Such a naive prediction would be incorrect for 165 observations.

TABLE 6

TESTS OF H_2

Panel 1. Constant dollar budgeted unit variable costs used in the tests (derived from Panel 2 of Table 5)

Relationship between currently budgeted volume and previous actual volume	$vcr_{ht} = .2$	$vcr_{ht} = .3$	$vcr_{ht} = .4$
$q^b_{ht} > q^a_{h,t-1}$	\$93.93	\$103.67	\$149.90
$q^b_{ht} < q^a_{h,t-1}$	\$34.97	\$ 43.93	\$ 79.69

Panel 2. Classification of observations with $x = 8.57$

	$D_{ht} > x$	$D_{ht} < x$	*Totals*
$FE_{ht} > 0$	301	25	326
$FE_{ht} < 0$	124	41	165
	425	66	491

Misclassifications = 124 + 25 = 149

Panel 3. Empirical distribution of the number of misclassifications (i.e., FE_{ht} and $D_{ht} - x$ have opposite signs) in 1000 random trials

Misclassifications	*Frequency*
Less than 156	0
156	1
157	3
158	7
159	7
160	22
161	36
162	86
163	155
164	278
165	404

Panel 4. T-test of the difference in mean D_{ht}

	Number of observations	*Mean D_{ht}*	*t-test of the difference in means: pooled variance estimate*	
			t	*one-tailed probability*
$FE_{ht} > 0$	326	51.25	3.05	.001
$FE_{ht} < 0$	165	44.55		

these fixed costs are not shed when volume decreases. In our test of H_2, we used the unit variable cost estimates generated in our test of H_1. Therefore, in the test of H_2, hospitals that anticipate increased volume have larger estimated unit variable costs than hospitals that anticipate decreased volume. The positive results in the test of H_2 can be traced to a tendency for hospitals to "overshoot" in their estimates of volume. That is, when a hospital anticipates an increase in volume, its estimate of volume tends to exceed actual volume; when a hospital anticipates a decline in volume, its estimate of volume tends to be less than actual volume. Out of the 491 observations used in the tests of H_2, 69.5 percent represent "overshooting." The question is, why do hospitals "overshoot"? "Overshooting" is perfectly consistent with, and indeed is predicted by, our hypotheses. According to H_1, a hospital that projects growth will tend to inflate unit variable costs; and by H_2, a hospital with inflated unit variable costs will tend to overestimate volume. According to H_1, a hospital that projects declining volume will tend to deflate unit variable costs; and by H_2, a hospital with deflated unit variable costs will tend to underestimate volume. The positive results for H_2 can only be explained away by providing a different explanation for why hospitals tend to "overshoot" their estimates of volume.

SUMMARY

The methods used in the state of Washington to regulate hospital revenues provide incentives for hospitals to bias forecasts of costs and of volume in predictable ways. The evidence in this paper is consistent with the existence of such biasing.

This result has implications for regulators, who should be aware that if opportunities exist for escaping the constraints imposed by regulation, they will likely be exploited.

More broadly, the evidence in this paper is consistent with agency theory. The principal in this case is the Washington State Hospital Commission and the agents are the hospitals (or, more properly, the hospitals' administrators). The principal has created an incentive scheme and a monitoring system to control the agents' behavior. Within the constraints of that incentive scheme and monitoring system, at least some agents appear to be acting in their own (and not the principal's) interests and with guile.

The results of this study are based on data pooled across time and across hospitals. This approach necessitated certain assumptions, including similarity of cost structures and of inflation rates across hospitals. Further insights may be obtained by both broadening and deepening the scope of analysis. The former refers to tests with hospitals facing different regulations (perhaps in different states), firms in other regulated industries, and regulatory changes. The latter would involve more detailed analysis of each hospital (or firm in the case of other industries). The different types of service that a hospital provides probably have different cost structures and revenue sources. Accordingly, the incentives for information biasing likely will also differ among them.

Another area in need of further research is the change in resource allocation activities in response to a new regulation. It is conceivable, in fact likely, that rate regulation induced hospitals to reexamine their organizational structures and processes in search of more effective/efficient approaches. Evidence on such adjustments is an integral part of assessing a regulation's efficacy and desirability.

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The Impact of Structure, Environment, and Interdependence on the Perceived Usefulness of Management Accounting Systems

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ABSTRACT: This paper examines the effect of structural decentralization, perceived environmental uncertainty, and organizational interdependence on Management Accounting Systems [MAS] design. MAS design was defined in terms of the perceived usefulness of several information characteristics which may be associated with an MAS. These characteristics were scope, timeliness, level of aggregation, and information which assists integration. In addition to examining the direct effects of contextual variables, the study sought to determine how the independent variables interacted. Hypotheses were generated for both direct and indirect effects of contextual variables and were tested using data collected from 68 managers. The findings indicated that: 1) Decentralization was associated with a preference for aggregated and integrated information; perceived environmental uncertainty with broad scope and timely information; organizational interdependence with broad scope, aggregated, and integrated information. 2) The effects of perceived environmental uncertainty and organizational interdependence were, in part, indirect through their association with decentralization.

In recent years, a succession of authors have called for more research which examines the influence of contextual settings on the effective design of Management Accounting Systems (MAS) [Sathe, 1975; Gordon and Miller, 1976; Ansari, 1977, 1979; Amigoni, 1978; Gordon, et al., 1978; Waterhouse and Tiessen, 1978; Banbury and Nahapiet, 1979]. While a variety of contingency (contextual) frameworks have been suggested, they generally share a concern with organizational factors such as the external environment, organizational size, diversity, technology, and formal structure.

Although considerable emphasis has been placed on potential benefits of contingency theory applications to accounting research, only a few empirical investigations exist [e.g., Khandwalla, 1972; Bruns and Waterhouse, 1975; Gordon and Narayanan, 1984; Kenis, 1979; Merchant, 1981; Hayes, 1977; Rockness and Shields, 1984; Govindarajan, 1984]. Perhaps empirical research is scarce because of both the complex interrelationships among contextual variables and the difficulties in developing theories of how these complex interactions influence the design

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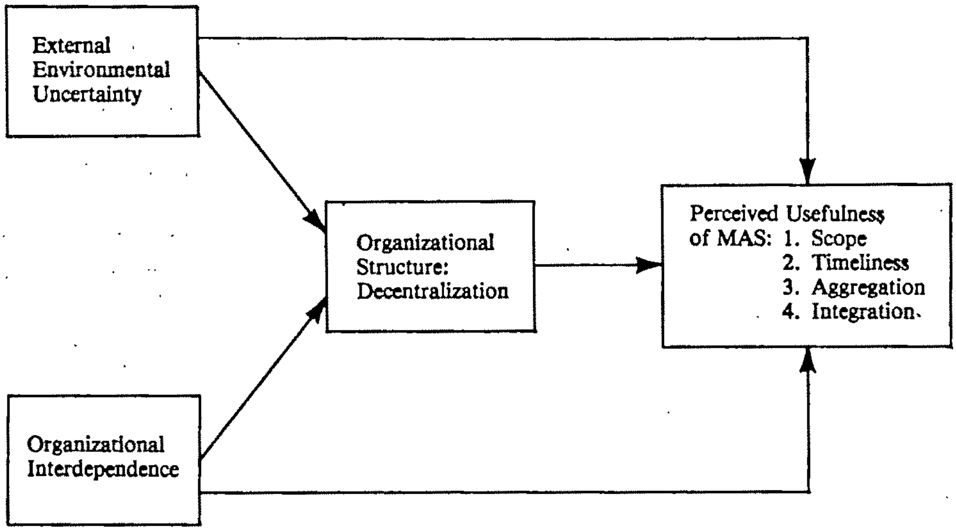
FIGURE 1
A CONTINGENCY MODEL OF PERCEIVED USEFULNESS OF MAS


External Environmental Uncertainty
Organizational Structure: Decentralization
Perceived Usefulness of MAS: 1. Scope
2. Timeliness
3. Aggregation
4. Integration.
Organizational Interdependence

of MAS [Waterhouse and Tiessen, 1978; Otley, 1980; Merchant, 1981]. Only Gordon and Narayanan [1984] have examined the effect of interactions between contextual variables on the design of MAS. They examined the effects on MAS design of perceived environmental uncertainty and organizational structure acting singly and in combination. This approach has particular promise in unravelling the complex effects of interacting contextual variables on MAS design. This paper reports the results of a study aimed at providing additional evidence on the effects of potentially interacting contextual variables on the design of MAS.

The framework for the research is presented in Figure 1. The study has three main purposes. First, it considers MAS design in terms of several broad information characteristics including 1) scope, 2) timeliness, 3) levels of aggregation (including an orientation to formal decision models) and 4) information on how activities are integrated. Second, the study investigates the relationship between managers' perceptions of the usefulness of these MAS information characteristics and 1) organizational structure, defined as the level of decentralized decision autonomy; 2) managers' perceptions of the uncertainty in their operating environments; and 3) organizational interdependence, defined as the extent of exchanges between different sections within the subunit.[1] In addition, the study examines interactions between the three contextual variables and their consequent combined effects on the perceived usefulness of information. Third, the research represents a partial replication of a recent study by Gordon and Narayanan [1984].

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[1] Studies into perceived usefulness of information posit that individuals have sufficient self-insight into their decision process so as to understand the importance of information to their task activity [Ashton, 1974; Bruns, 1968; Joyce, 1976]. While some evidence exists that self-insight is poor [Slovic and Lichtenstein, 1971; Nisbett and Wilson, 1977], use of "real world" decision makers as respondents is likely to improve the quality of managerial self-insight [Larcker, 1981]. See Wright [1977] for discussion of the self-insight issue.

The next section of the paper presents the experimental variables considered in the research and a theoretical discussion of the direct and indirect effects of contextual variables on perceived usage, including a statement of hypotheses. The following sections address the research method, results, discussion, and conclusions.

EXPERIMENTAL VARIABLES AND HYPOTHESES

This section derives six hypotheses for empirical investigation. First, the selected contextual variables are identified. A review of the literature related to the potential effects of contextual variables on the perceived usefulness of each information characteristic follows. Next, the indirect effects on perceived information usefulness of perceived environmental uncertainty and organizational interdependence acting through decentralization are examined.

The Independent Variables

The variables of decentralization, perceived environmental uncertainty, and organizational interdependence were identified as important dimensions of context in the study of MAS design.

Decentralization refers to the level of autonomy delegated to managers. Decentralization provides managers with greater responsibility over planning and control activities and greater access to information not available to the corporate body [Waterhouse & Tiessen, 1978]. The importance of decentralization as an element of context in designing MAS is stressed by Lorsch [1970] and Watson [1975], who refer to MAS as supportive mechanisms which should be consistent with the intent of the formal structural arrangements.

Perceived environmental uncertainty has been identified as an important contextual variable because it makes managerial planning and control more difficult [Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Weick, 1969; Duncan, 1972]. Planning becomes problematic in uncertain operating situations because of the unpredictability of future events. Control activities are also likely to be influenced by uncertainty. For example, sub-units which face unpredictable change may find that static budgets are ineffective control devices because the initial standards rapidly become out of date.

Organizational interdependence refers to the exchange of output that takes place between segments within a sub-unit. Thompson [1967] separated situations of no exchanges between segments (pooled) from interdependent situations which involve either sequential or reciprocal exchanges.[2] Organizational interdependence is an important element of context in the design of MAS because of the increased problems of coordinating interdependent compared with pooled situations [Baumler, 1971; Watson, 1975].

Dependent Variables—Information Characteristics

Four dimensions of information were selected because of theoretical links between decentralization, perceived environmental uncertainty, organizational interdependence, and the perceived use-

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[2] Sequential interdependence involves the outputs of one segment becoming the inputs of other segments (one segment cannot act prior to receiving input from other segments) and reciprocal exchanges exist where segments exchange their output with each other (a segment provides outputs to other segments and receives inputs from other segments).

FIGURE 2
INFORMATION CHARACTERISTICS

Scope	: External information : Nonfinancial information : Future-oriented (e.g., probabilistic)
Timeliness	: Frequency of reporting : Speed of reporting
Aggregation	: Aggregated by time period : Aggregated by functional area : Analytical or decision models (e.g., marginal analysis, DCF, inventory models)
Integration	: Precise targets for activities and their interrelationship within sub-unit : Reporting on intra-sub-unit interactions

FIGURE 3
SUMMARY OF PROPOSED DIRECT EFFECTS OF CONTEXTUAL VARIABLES ON DEPENDENT VARIABLES

	Perceived Usefulness of Information Characteristics			
Context	*Scope*	*Timeliness*	*Aggregation*	*Integration*
Decentralization	X	N.R.	X	X
Perceived environmental uncertainty	X	X	X	N.R.
Organizational Interdependence	X	N.R.	N.R.	X

N.R. = not relevant to that information characteristic.

fulness of these information dimensions. The dimensions are scope, timeliness, aggregation, and integration. A summary of the information characteristics is provided in Figure 2.

This section first describes the information characteristics and identifies potential direct effects of contextual variables on the perceived usefulness of each information variable. This is followed by an examination of possible indirect effects of perceived environmental uncertainty and organizational interdependence acting through decentralization. A summary of the proposed direct effects of contextual variables on the various information dimensions is presented in Figure 3.

Scope

The scope of an information system refers to the dimensions of focus, quantification, and time horizon [Gorry and Scott Morton, 1971; Larcker, 1981; Gordon and Narayanan, 1984]. A traditional MAS provides information which focuses on events within the organization, is quantified in monetary terms, and relates to historical data. A broad scope MAS provides information related to the external environment which may be economic (such as G.N.P., total market sales, and a company's share of that market) or non-economic (such as demographic factors, consumer tastes, competitors' actions, and technological advances). Broad scope MAS would include non-monetary measurement of many of these external environmental characteristics [Gordon and Miller, 1976]. In addition, broad scope MAS would provide estimates of the likelihood of future events occurring, possibly in probabilistic terms [ASOBAT, 1966, p. 55].

It is proposed that all three contextual variables will influence the exent to which managers perceive broad scope information as useful. First, in decentralized sub-units it seems plausible that broad scope information would be useful in servicing the diversity of decisions faced by the decentralized manager and in providing localized environmental information [Horngren, 1982, pp. 9–13; Lander et al., 1983, p. 43]. In an early study, Simon, et al. [1954] referred to the usefulness of broadly based "attention directing" and "problem solving" information to assist decentralized managers in areas such as pricing, marketing, inventory control, and labor negotiations.

Secondly, evaluation of performance in sub-units which have high levels of organizational interdependence is likely to be assisted by broad scope, nonfinancial information. Hayes [1977] found that performance measures of highly interdependent sub-units were most useful if they included measures to assess managers' reliability, cooperation, and flexibility.

Lastly, the difficulties caused by perceived environmental uncertainty to both planning and control may be alleviated by provision of broad scope information. While it cannot be claimed unequivocally that the provision of future-oriented and analytical information (aggregations) improves the outcomes of decision making, there is some evidence that managers who perceive their environments as uncertain find this type of information useful. Gordon and Narayanan [1984] reported the importance of future-oriented information to managers facing uncertainty. It is also likely that broad scope information would aid control in uncertain situations by focusing information on the sources of uncertainty. Both Hayes [1977] and Govindarajan [1984] indicated that traditional financial evaluation measures are ineffective for evaluation of boundary-spanning activities which are particularly susceptible to environmental uncertainty. Hayes found that in research and development, department managers sought evaluative measures which related directly to the environment such as stability, diversity, dealer opinions, market share, and planning ability.

In summary, it may be proposed that MAS which provide broad scope information will be perceived as useful by managers of decentralized sub-units, by those operating sub-units with high levels of organizational interdependence, and by those who perceive their operating situation as uncertain.

Hypothesis 1:

There is a direct relationship between the perceived usefulness of the MAS characteristic of broad scope and the three contextual variables of 1) decentralization, 2) perceived environmental uncertainty, and 3) organizational interdependence.

Timeliness

A manager's ability to respond quickly to events is likely to be influenced by the timeliness of the MAS. Timeliness is usually specified in terms of the provision of information on request and the frequency of reporting systematically collected information. Timely information enhances the facility of MAS to report upon the most recent events and to provide rapid feedback on decisions.

Of the three contextual variables included in this study, only perceived environmental uncertainty is expected to influence the perceived usefulness of timely information. In uncertain situations, managers are likely to find that they need to respond rapidly to unpredictable change and, as a consequence, they would find timely information particularly useful. Amey [1979] argued that MAS should provide dynamic and exogenous information to enable managers to respond effectively to environmental uncertainty. Moreover, he claims that this type of information is largely ignored in traditional MAS.

Hypothesis 2:

> There is a direct relationship between the perceived usefulness of the MAS characteristic of timeliness and the contextual variable of perceived environmental uncertainty.

Aggregation

MAS may provide information in various forms of aggregation ranging from provision of basic raw, unprocessed data to a variety of aggregations around periods of time or areas of interest such as responsibility centers, or functional areas. An additional type of aggregation refers to summation in formats consistent with formal decision models such as discounted cash flow analysis for capital budgeting, simulation and linear programming in budgetary applications, cost-volume-profit analysis, and inventory control models. In the current study, aggregated information is a composite of temporal and functional summation (e.g., sales area, cost center, marketing and production departments), and information produced specifically for formal decision models.

It is proposed that the contextual variables of decentralization and perceived environmental uncertainty will influence the perceived usefulness of aggregated information. The aggregations to be affected by decentralization are those concerned with performance measures. Decentralized managers are likely to prefer to be evaluated on performance measures, which are aggregated in ways which reflect their area of responsibility [Gordon, 1963; Pick, 1971; McNally, 1980; Horngren, 1982]. Lower morale and increased conflict have been seen as potential consequences of using conventional accounting evaluation measures that do not reflect the autonomy of, and integration between, sub-unit activities [Ansari, 1979; Shillinglaw, 1972, p. 426].

Many decision models have been designed to assist the management of uncertainty. Management accounting textbooks provide numerous examples of formal models to assist planning and statistical techniques to analyze uncertainty (e.g., Horngren [1982]). Amigoni [1978] asserted that financial simulation models should be provided by an MAS in highly turbulent environments. Pfeffer and Leblebici [1973] found that high levels of environmental competitiveness increased managers' demands for formal decision procedures.

In summary, aggregated information will be perceived as useful by decentralized managers and by managers who perceive their environments as uncertain.

Hypothesis 3:

> There is a direct relationship between the perceived usefulness of the MAS characteristic of aggregation and the two contextual variables of 1) decen-

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tralization, and 2) perceived environmental uncertainty.

Integration

An important aspect of organizational control is coordination of the various segments within a sub-unit. MAS characteristics which may assist coordination would include the specification of targets which account for the effects of interacting segments and information on the impact that decisions in one area have on operations throughout the sub-unit.

It is proposed that the perceived usefulness of integrated information will be influenced by the contextual variables of decentralization and organizational interdependence. As sub-units become more decentralized, it is likely that the diversity of activities will increase. If this is the case, then presumably integrated information would be helpful in coordinating the increased diversity of operating decisions.

Organizational interdependence tends to affect planning and control with high levels of interdependence, complicating the task of coordination. Therefore, in highly interdependent situations, managers are likely to find MAS which provide integrative information—such as the impact of decisions throughout the sub-unit—to be particularly useful, while in pooled situations, such information is likely to be less relevant [Baumler, 1971; Galbraith, 1973, p. 32]. There is also a possibility of poor morale if evaluation measures do not reflect the integration between sub-unit activities [Ansari, 1979; Shillinglaw, 1972, p. 426].

To summarize, integrative information will be perceived as useful by managers in decentralized sub-units and by managers operating in situations of high organizational interdependence.

Hypothesis 4:

There is a direct relationship between the perceived usefulness of the MAS characteristic of integration and the two contextual variables of 1) decentralization and 2) organizational interdependence.

Indirect Effects

The previous section has considered the direct effects of contextual variables on the perceived usefulness of information. If both perceived environmental uncertainty and organizational interdependence can be linked to decentralization, then indirect effects on the information dimensions of the former contextual variables acting through decentralization may be proposed.

Perceived Environmental Uncertainty —Decentralization

This section proposes that perceived environmental uncertainty induces decentralization, and therefore the effects of the former on information characteristics may be, in part, due to the indirect path through decentralization. The information characteristics which may be influenced by this indirect effect are those which are proposed to be directly related to both perceived environmental uncertainty and decentralization. From consideration of the previous hypotheses, these characteristics are broad scope (hypothesis 1) and aggregation (hypothesis 3).

Several authors have argued that an appropriate structural response for organizations facing uncertainty is to encourage managers to "differentiate" their segments with respect to their sub-unit's environment [Lawrence and Lorsch, 1967; Lorsch and Allen, 1973; Walker and Lorsch, 1968]. These managers will have more decentralized authority to develop their own goals and management styles. Such arrangements are aimed at improving performance by encouraging managers to develop distinctive competences for dealing with uncertainty. Thompson [1967] also stresses the need for "localized" decentralized sub-units as a structural response to unpredictable environments. Similarly, Galbraith [1973] claims that, in uncertain situations, relevant information is required at the time and place of task execution and, further, that decentralized structure facilitates this information processing. From an accounting viewpoint, both Waterhouse and Tiessen [1978] and Gordon and Miller [1976] suggest that decentralization is an appropriate response to dynamic environments and that broad scope, nonfinancial information is required in such settings. Thus, it may follow that managers operating in uncertain situations will have more autonomy over decision making and therefore have demands for information relevant to decentralized sub-units. As a consequence, the association between perceived environmental uncertainty and the information variables may be partly due to the effect of decentralization.

Hypothesis 5:

> There is an indirect relationship between the perceived usefulness of the two MAS characteristics of 1) broad scope and 2) aggregation, and perceived environmental uncertainty acting through decentralization.

Organizational Interdependence—Decentralization

Part of the association between organizational interdependence and perceived MAS usefulness may be indirect through the effect of interdependence on decentralization. The information characteristics influenced by this indirect effect are broad scope and integration, both of which have direct effects with decentralization and organizational interdependence (hypotheses 1 and 4).

According to March and Simon [1958] and Thompson [1967], organizations with segments that are highly interdependent seek to minimize coordination costs by grouping the interdependent segments together and by providing a manager with sufficient autonomy to administer the resultant sub-unit. In situations with low levels of interdependence there are fewer integration problems and, as a consequence, less need to provide managers with decentralized authority. Thompson [1967, p. 75] argued that in the absence of strong, continuing interdependence, organizations are likely to centralize decision making for scheduling the work of different independent segments. Galbraith [1973] provides further support, asserting that the costs and difficulties associated with information processing to coordinate interdependence are reduced by containing the interdependence within decentralized sub-units. Several of the Aston studies identified a positive association between high levels of work-flow integration (the degree of automated, interdependent, fixed-sequence operations) and delegated authority [Pugh, et al., 1969; McMillan, et al., 1973]. Thus, organizational interdepenence may induce decentralization and, as a consequence, the association between interdependence and the information characteristics may be due, in part, to the effects of decentralization.

Hypothesis 6:

> There is an indirect relationship between the perceived usefulness of the two MAS characteristics of 1) broad scope and 2) integration, and organizational interdependence acting through decentralization.

RESEARCH METHOD

Sixty-eight managers drawn from 36 different manufacturing organizations in the Sydney metropolitan area participated in the study. The unit of analysis was sub-units within organizations. Managers were at middle to upper levels in their organization's formal hierarchy, and all were actively involved in both revenue-generating and cost-incurring activities for their sub-unit. This broadly based sample assured a wide range of environmental characteristics, production technologies, and levels of managerial autonomy. The organizational sub-units ranged in size from 50 to 220 employees.

Data were gathered by interviews based on structured questionnaires. Of the 68 respondents, 56 percent held qualifications at the post-high-school level, and all had attended some executive training program which included a finance-accounting segment within the previous five years.[3] The average age was 34.2 years, and the average time spent in their current organization was 7.2 years.

The Measurements

The interview questionnaire was developed from existing studies, where possible, to enhance the validity and reliability of measures. However, in the case of information qualities, a set of questions suited to the study was constructed.

Contextual Variables

Decentralization was measured by the abbreviated Aston measures of "Concentration of Authority" [Inkson, et al., 1970]. Concentration of authority is measured using a series of standard decisions and identifies whether managers have decision autonomy. The Cronbach alpha statistic of internal reliability was 0.82 on this measure [Cronbach, 1951].

Perceived environmental uncertainty was measured using an instrument developed by Duncan [1972] and revised by Sathe [1974]. The instrument measures perceived uncertainty by focusing on lack of information on environmental factors, inability to assign probabilities with confidence as to how the environment will affect success or failure, and not knowing the outcome of a decision in terms of how much the organization would lose if the decision were incorrect. The instrument measures the frequency with which 12 items occur in the respondent's job, using a five-point scale ranging from never to always. The internal reliability of the 12-item scale was 0.71 using the Cronbach alpha statistic.

Organizational interdependence was measured using a slightly modified version of the "interdependence of workflow" instrument developed by Pugh, et al. [1969]. This asked respondents to indicate which one of the three descriptions of intra-sub-unit work-flow integration most nearly applied to their sub-unit. The three descriptions corresponded with pooled, sequential, and reciprocal interdependence discussed earlier. Reciprocal and sequential modes were combined to indicate relatively higher independence than the pooled category.

Dependent Variable

The managers' perceptions of the information characteristics of MAS were measured using a self-scoring instrument which involved rating the extent to which a series of information items would be useful to them in carrying out the overall tasks of their sub-unit. The five-point scale ranged from "not at all useful" to "most useful." A set of questions was developed for each of the four information dimensions from discussions with numerous managers, professional management accountants, and academics during the early stages of the research. After considerable testing on an initial 40 items covering all information dimensions, the questionnaire was reduced to 24 items.

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[3] Initial contact was made through executive programs at Sydney-based institutions.

TABLE 1

FACTOR LOADINGS ON INFORMATION CHARACTERISTICS

Factors**	*Factor Loadings (Rounded)*			
	I	*II*	*III*	*IV*
I. Scope				
External information (4)	.74	.11	−.04	−.06
Noneconomic information (3)	.59	−.09	.08	.13
Future-oriented (1)	.47	−.03	.11	−.07
Nonfinancial-market (5b)	.44	−.13	.16	.04
Probabilistic (2)	.42	.02	.39	.05
Nonfinancial-production (5a)	.40	−.09	.21	.07
II. Timeliness				
Speed of reporting (6)	−.07	.79	.04	.09
Frequency of reporting (8)	.04	.71	.10	.05
Automatic receipt (7)	−.02	.47	.06	−.03
Immediate reporting (9)*	−.12	.32	.15	.02
III. Aggregation				
Separate fixed/variable costs (16)	−.06	.01	.89	−.09
Summary reports-sections (13a)	.09	−.05	.71	.29
Sectional reports (10)	.05	−.03	.62	.36
Temporal reports (11)	.07	.12	.58	−.02
Decision models: incremental (15b)	.14	.06	.53	−.08
"What-if" statements (14)	.17	.02	.49	−.05
Decision models: DCF (15a)	.11	.07	.47	.06
Effect of events on functions (12)*	.13	.09	.36	.31
Summary reports-organization (13b)*	.09	.02	.21	.31
Decision models: inventory (15c)*	.21	−.06	.18	.24
credit policy (15d)*	.17	−.04	.16	.14
IV. Integration				
Precise targets (18)	−.09	.07	.17	.71
Organizational effects (19)	.04	.01	.09	.53
Sub-unit interaction (17)	.11	.03	.31	.44
Percentage of variance	37.82	17.71	15.96	7.31

* Excluded from final scales because factor loadings <.40.

** Numbers in parentheses refer to Appendix A.

These items are presented in Appendix A. Data from this questionnaire were factor analyzed to confirm the theoretical groupings (construct validity) of items as specified in Figure 2 [Kerlinger, 1964]. The initial principal factor matrix was rotated orthogonally (varimax) to reach a final solution. Four factors with eigenvalues greater than one were extracted which accounted for 78.80 percent of the total variance. Table 1 shows the factor loadings after rotation, the percentage of variance explained by each factor, and a descriptive factor title. Measures for each information characteristic were calculated by taking arithmetic averages of scores on those items which loaded greater than 0.40 on the relevant factor. Averages were used to enhance the face validity of the characteristics and to aid interpretation of the scores. Cronbach alpha statistics of 0.76 for broad scope, 0.71 for timeliness, 0.81 for aggregation, and 0.73 for integration indicated satisfactory internal reliability for the information scales.

TABLE 2
DESCRIPTIVE STATISTICS FOR INFORMATION AND CONTEXTUAL VARIABLES

	Mean	Standard Deviation	Range
Perceived usefulness of MAS information:			
Broad Scope	23.11	7.94	6–30
Timeliness	11.73	2.87	3–15
Aggregation	24.46	8.73	7–35
Integration	10.08	2.15	3–15
Contextual Variables			
Decentralization	13.46	4.31	0–23
Uncertainty	25.32	8.16	12–60
Interdependence	0.68	0.19	0–1

Table 2 presents descriptive statistics for information and contextual variables.

RESULTS

To test the direct effects of contextual variables on perceived usefulness of information (hypotheses 1, 2, 3, and 4), the following four regressions were estimated:

$$X_{4i}=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3 \qquad (1)$$

where

X_1 = decentralization,
X_2 = perceived environmental uncertainty,
X_3 = organizational interdependence, and
X_{4i} = perceived usefulness of broad scope information ($i=1$), timely information ($i=2$), aggregated information ($i=3$), and integrated information ($i=4$).[4]

The results of these regressions are presented in Table 3.

To test the indirect effects on perceived information usefulness of the uncertainty and interdependence variables acting through decentralization (hypotheses 5 and 6), a path analysis was used. The model is presented in Figure 4.

In the path analysis, the relationships between variables were specified by a series of path coefficients (p_{ij}) which are equivalent to the standardized beta coefficients found by first regressing X_4 against X_1, X_2, and X_3, and then X_1 against X_2 and X_3 [Duncan, 1966; Heise, 1969]. The first regression equation was presented above (equation 1) while the second is:

$$X_1=\alpha_1+\alpha_2X_2+\alpha_3X_3. \qquad (2)$$

The results of both regressions including the beta coefficients are presented in Table 3. In Figure 4, R_k denotes the unexplained variance associated with decentralization and perceived usefulness of information characteristics.

The model may be presented in equation form as follows:

$$X_4=p_{41}X_1+p_{42}X_2+p_{43}X_3+p_{4b}R_b,$$
and
$$X_1=p_{12}X_2+p_{13}X_3+p_{1a}R_a$$

The direct and indirect effects of contextual variables are found by combining the path coefficients and the zero-order correlations as in Figure 5.

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[4] Correlations between information dimension scores were not significant, thereby ensuring that the four regressions were independent tests.

TABLE 3
RESULTS OF REGRESSIONS

Equation 1: X_4 against X_1, X_2, X_3

	Coefficient	Value	Standard Error	t	Probability
Hypothesis 1.					
Scope					
Decentralization	β_1	0.04	0.108	0.37	n.s.
Uncertainty	β_2	0.35	0.110	3.17	<.01
Interdependence	β_3	0.33	0.115	2.88	<.01
$R^2=0.27$, $F=7.86$, $p<.01$					
Hypothesis 2.					
Timeliness					
Decentralization	β_1	0.02	0.105	0.19	n.s.
Uncertainty	β_2	0.39	0.118	3.31	<.01
Interdependence	β_3	0.00	0.007	0.41	n.s.
$R^2=0.16$, $F=4.08$, $p<.05$					
Hypothesis 3.					
Aggregated					
Decentralization	β_1	0.37	0.112	3.30	<.01
Uncertainty	β_2	0.03	0.094	0.32	n.s.
Interdependence	β_3	0.32	0.108	2.95	<.01
$R^2=0.33$, $F=10.60$, $p<.01$					
Hypothesis 4.					
Integrated					
Decentralization	β_1	0.27	0.121	2.23	<.05
Uncertainty	β_2	0.04	0.108	0.37	n.s.
Interdependence	β_3	0.36	0.127	2.82	<.01
$R^2=0.25$, $F=7.00$, $p<.01$					

Equation 2: X_1 against X_2 and X_3

	Coefficient	Value	Standard Error	t	Probability
Decentralization					
Uncertainty	α_2	0.24	0.111	2.16	<.05
Interdependence	α_3	0.32	0.113	2.84	<.01
$R^2=0.17$, $F=6.89$, $p<.01$					

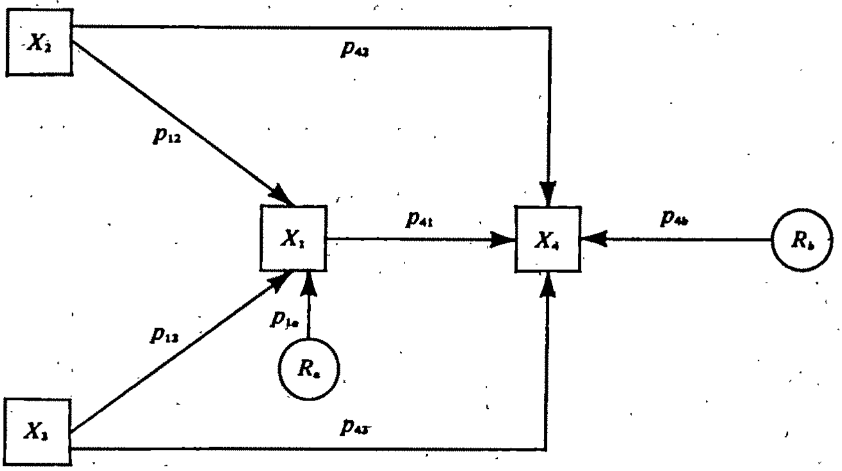
Results of Direct Effect Hypotheses 1, 2, 3, and 4

The results of regression equation 1 reported in Table 3 indicate that broad scope information was significantly associated with perceived environmental uncertainty and organizational interdependence, but not with decentralization. These results allow rejection of the implied null hypothesis of no relationship for two of the three proposed associations specified in hypothesis 1. The significant association between timeliness and environmental uncertainty supports rejection of the null for hypothesis 2.

The results related to aggregated information support only part of the proposed effects specified in hypothesis 3. Aggre-

FIGURE 4

PATH ANALYSIS—STRUCTURAL MODEL



gated information was significantly associated with decentralization and organizational interdependence. The association with decentralization was proposed; however, the significant relationship with organizational interdependence was unexpected. The hypothesized association between aggregation and uncertainty was not supported by the regression analysis.

The results of the regression analysis as applied to the integrated information variable allowed rejection of the null of hypothesis 4 that proposed an association between integrated information and both decentralization and organizational interdependence.

Results of Indirect Effect Hypotheses 5 and 6

The results of the path analysis presented in Table 4 provide support for rejection of the null for several of the hypothesized indirect effects. Hypothesis 5 proposed an indirect effect of perceived environmental uncertainty acting through decentralization for the information characteristics of broad scope and aggregation. Section 1 of Table 4 indicates that there were indirect effects for aggregated information, but not for broad scope information.

The observed correlation between the uncertainty variable and aggregated information, $r_{24}=0.16$, decomposed into a 0.03 direct effect, a 0.10 indirect effect through decentralization, and a 0.03 spurious correlation. In considering this result it should be noted that the overall effect of uncertainty on aggregation was not significant (hypothesis 3). The association between broad scope information and perceived environmental uncertainty, $r_{24}=0.39$, was mainly a direct effect of 0.35 with a 0.01 indirect effect and a 0.03 spurious correlation. The absence of an indirect effect can be explained by the insignificant relationship between decentralization and broad scope information.[5] These results allow

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[5] While the association between decentralization and broad scope was not statistically significant, it can be seen from Section 3 of Table 4 that the influence of decentralization acting alone was minimal and that the ob-

TABLE 4

DECOMPOSITION OF EFFECTS

Section 1. Hypothesis 5: Decomposition of correlation between perceived environmental uncertainty and information characteristics.

	Observed Correlation r_{24}	*Direct Effect*	*Indirect Effect through Decentralization*	*Spurious**
Scope	0.39	0.35	0.01	0.03
Timeliness	0.40	0.39	0.01	
Aggregation	0.16	0.03	0.10	0.03
Integration	0.14	0.04	0.07	0.03

Section 2. Hypothesis 6: Decomposition of correlation between organizational interdependence and information characteristics.

	Observed Correlation r_{34}	*Direct Effect*	*Indirect Effect through Decentralization*	*Spurious*
Scope	0.37	0.33	0.01	0.03
Timeliness	0.04	0.001	0.007	0.03
Aggregation	0.45	0.32	0.13	
Integration	0.48	0.36	0.09	0.02

Section 3. Additional Analysis: Decomposition of correlation between decentralization and information characteristics.

	Observed Correlation r_{14}	*Direct Effect*	*Indirect Effect through Uncert. & Interdep.*		*Spurious*
Scope	0.26	0.04	0.10	0.11	0.01
Timeliness	0.13	0.02	0.11	0.007	
Aggregation	0.49	0.37	0.01	0.11	
Integration	0.39	0.27	0.01	0.11	

The correlation between perceived environmental uncertainty and decentralization (r_{21}) was 0.27, and between organizational interdependence and decentralization (r_{31}) was 0.34.

* See Asher [1976] for a discussion of spurious effects. It is also noted that path analysis provides evidence on empirical relations found in the data. These do not represent proof of the direction or significance of direct and indirect effects.

non-rejection of the hypothesized indirect relationship between perceived environmental uncertainty and the perceived usefulness of aggregated information. Hypothesis 6 states that organizational interdependence will have an indirect effect through decentralization on broad scope and integrated information. Section 2 of Table 4 provides support for the indirect effect of organizational interdependence for the integration dimension, but not for broad scope. The observed correlation between integrated information and organizational interdependence, $r_{34}=0.48$, decomposed into a 0.36 direct effect and a 0.09 indirect effect through decentralization. For broad

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served correlations were due largely to the effects of other contextual variables which related significantly to decentralization. The correlation between decentralization and broad scope information, $r_{14}=0.26$, was due mainly to the influence of perceived uncertainty, 0.10, and technological interdependence, 0.11.

FIGURE 5

DIRECT AND INDIRECT EFFECTS FROM PATH ANALYSIS

			Decomposition of association		
Combinations of Variables	*Observed Correlation*		*Direct effects*		*Indirect effects*
X_2 with X_1	r_{21}	=	p_{12}		
X_3 with X_1	r_{31}	=	p_{13}		
X_2 with X_4	r_{24}	=	p_{42}	+	$p_{41}r_{21}$
X_3 with X_4	r_{34}	=	p_{34}	+	$p_{41}r_{31}$
X_1 with X_4	r_{14}	=	p_{41}	+	$p_{42}r_{21}+p_{43}r_{31}$

scope information, the observed correlation with organizational interdependence of $r_{34}=0.37$ was mainly a direct effect of 0.33, with 0.01 indirect and 0.03 spurious correlation. These results allow non-rejection of hypothesis 6 for the integrated information dimension. It is also apparent from section 2 of Table 4 that there was a strong indirect effect of organizational interdependence acting through decentralization for the aggregated information dimension. The observed correlation between aggregation and organizational interdependence of $r_{34}=0.45$ comprised a 0.32 direct effect and a 0.13 indirect effect through decentralization. This indirect effect, which was not hypothesized, is a consequence of the unexpected finding that there was a significant direct association between aggregated information and organizational interdependence (hypothesis 3).

DISCUSSION OF RESULTS

This study sought to improve our understanding of the characteristics of MAS perceived by managers to be potentially useful to their administrative tasks. Specifically, the goal was to relate a selection of information characteristics to the context of managers' operating situations. The results of the study assist in understanding how contextual variables act singly and in combination.

Research findings provided by Gordon and Miller [1976], Larcker [1981], Gordon and Narayanan [1984], and the current study suggest that it is helpful to consider MAS design in terms of general information characteristics. Schemes which identify dimensions of information, such as the one developed in this research, can sensitize the designers of technical facets of MAS (such as budgetary planning and control systems) to the underlying qualities of information perceived by managers to be useful.

The study indicates that organizational interdependence is important when designing an MAS. Broad scope, aggregated and integrated information were perceived as useful by managers of subunits who had interdependent operations. The results relating the perceived usefulness of broad scope and timely information to perceived environmental uncertainty are consistent with claims that managers facing uncertainty should be provided with information to improve their decision response time and to aid in environmental scanning [Ansoff, 1964; Thompson, 1967; Cannon, 1968; Newman and Logan, 1971; Khandwalla, 1977]. More specifically, the association between broad scope and perceived environmental uncertainty is similar to the findings of Gordon and Narayanan [1984]. Aggregated information was not, however, associated with perceived uncertainty. This result is surprising, given that aggregated and analytical information is often generated to assist in analyzing uncertainty. Perhaps the items used to measure this variable were not sufficiently focused on the analytical aspects helpful to managing uncertainty. In summary, the findings suggest that attempts by the designers of MAS to improve response time and to assimilate information from many sources into a broad scope MAS are of particular relevance to managers who perceive their operating situation as uncertain.

The study also indicates that aggregated and integrated information is perceived favorably by decentralized managers. This supports the view that responsibility accounting systems should aggregate and integrate information in ways that recognize the complexities and interdependencies found in many decentralized operations [Horngren, 1982; Pick, 1971; Ferrara, 1964]. It is noteworthy that broad scope and timely information were not significantly associated with decentralization. Apparently, centralized managers found that these information characteristics could be applied just as readily to their more limited decision set.

An important result of the study is the relationships between contextual variables. These findings support the view that organizations consider the level of organizational interdependence and environmental uncertainty before decentralizing [Thompson, 1967]. Of particular interest was the effect that organizational interdependence had both directly on the perceived usefulness of broad scope, aggregated, and integrated information, and a strong secondary or indirect effect on aggregated and integrated information through its influence on decentralization. Perceived environmental uncertainty had an indirect effect through decentralization on aggregated information only.

Several limitations of the current study may be noted. While established measurement instruments were used in most of the study, the perceived information questionnaire is novel. While considerable attention was paid to the issue of validity, further work is needed to refine this instrument. The study examined statistical associations at one point in time, and statements about the direction of relationships can only be made in terms of consistency of results with the effects proposed in the theoretical discussion.

In addition to replications of this study with more refined theoretical linkages and measurement instruments, further research should relate information characteristics to particular aspects of MAS such as budgetary planning and control systems, and to different types of managerial work such as pricing, investment, evaluating, investigating, and negotiating. Perhaps, most importantly, the effect of different types of MAS on managers' performance should be investigated. It is hoped that such approaches will enhance our abilities to understand what types of MAS are appropriate in different situations and, as a result, to improve the likelihood that MAS will help managers improve their performance and that of their organizations.

APPENDIX A*

Scope

1. Information which relates to possible future events (if historical information is most suitable for your needs, mark the lower end of the scale).
2. Quantification of the likelihood of future events occurring (e.g., probability estimates).
3. Noneconomic information, such as customer preferences, employee attitudes, labor relations, attitudes of government and consumer bodies, competitive threats, etc.
4. Information on broad factors external to your organization, such as economic conditions, population growth, technological developments, etc.
5. Nonfinancial information that relates to the following areas:
   (a) production information such as output rates, scrap levels, machine efficiency, employee absenteeism, etc.
   (b) market information such as market size, growth share, etc. (If you find that a financial interpretation of production and marketing information is most useful for your needs, please mark the lower end of the scale.)

Timeliness

6. Requested information to arrive immediately upon request.
7. Information supplied to you automatically upon its receipt into information systems or as soon as processing is completed.
8. Reports are provided frequently on a systematic, regular basis: e.g., daily reports, weekly reports (for less frequent reporting, mark lower end of scale).
9. There is no delay between an event occurring and relevant information being reported to you.

Aggregation

10. Information provided on the different sections or functional areas in your organization, such as marketing and production, or sales, cost, or profit centers.
11. Information on the effect of events on particular time periods (e.g., monthly/quarterly/annual summaries, trends, comparisons, etc.).
12. Information which has been processed to show the influence of events on different functions, such as marketing or production associated with particular activities or tasks.
13. Information on the effect of different sections' activities on summary reports such as profit, cost, revenue reports for:
    (a) your particular sections ____________________
    (b) the overall organization ____________________
14. Information in forms which enable you to conduct "what-if" analysis.
15. Information in formats suitable for input into decision models such as:
    (a) discounted cash flow analysis ____________________
    (b) incremental or marginal analysis ____________________
    (c) inventory analysis ____________________
    (d) credit policy analysis ____________________
16. Costs separated into fixed and variable components.

*Questions were randomized in actual questionnaire.

Integration

17. Information on the impact that your decision will have throughout your department, and the influence of other individuals' decisions on your area of responsibility.
18. Precise targets for the activities of all sections within your department.
19. Information that relates to the impact that your decisions have on the performance of your department.

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Dollar-Unit Sampling: A Comparison of the Quasi-Bayesian and Moment Bounds

Lowell Dworin and Richard A. Grimlund

ABSTRACT: Test results are presented on the relative performance of two new auditing procedures for dollar-unit sampling—the quasi-Bayesian method developed by McCray [1984] and a slightly modified version of the moment method developed by Dworin and Grimlund [1984]. Extensive simulation studies of 96 representative accounts receivable and inventory populations were conducted. Both methods were found to be reliable over the tested range, and both provided tighter confidence bounds than those provided by the Stringer bound. This is the first study that has been made of the reliability of the quasi-Bayesian bound and of the comparative performance of the quasi-Bayesian and the moment methods. The moment method provided a tighter confidence bound at low error rates. For populations with high error rates, for which the true mean error was either very nearly zero or very large, the quasi-Bayesian method provided a tighter bound. Both bounds provided comparable results for the remaining intermediate cases. While either can be successfully used in these cases, the moment method appears to be easier to implement on currently available personal computers.

In recent issues of THE ACCOUNTING REVIEW, two new statistical procedures for evaluating the dollar-unit samples of an audit have been presented. One of these methods, the quasi-Bayesian (QB) bound developed by McCray [1984], assumes that the sampling distribution for an accounting population's mean error tainting may be represented by a "quasi" maximum likelihood function which is reflective of the actual errors observed in the audit sample.[1] Extensive iterative calculations are then used to (1) numerically define this function and (2) perform the required integration over it in order to determine percentiles and confidence bounds.

The second method, the moment (MT) bound developed by Dworin and Grimlund [1984], assumes that the sampling distribution can be represented by a

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[1] This distribution is described by McCray as a Bayesian posterior distribution with a discrete uniform prior distribution. In this paper we do not consider alternative QB procedures in which an informative prior judgment is used.

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three-parameter gamma distribution. The parameters of the gamma distribution are obtained from the first three sample moments, calculated from the observed sample error taintings and an additional hypothetical error tainting. As with the QB bound, confidence bounds for the MT method are based on percentiles of this sampling distribution. However, in the case of the MT bound, these percentiles are easily found using a very accurate analytical approximation. Consequently, for this and other reasons, the MT bound requires decidedly less extensive computations than the QB bound.

Despite the difference in the complexity of the numerical analysis required, the two methods have much in common. Both methods provide an explicit distribution for the mean error. Unlike classical sampling distributions, which incorporate only sample information, these distributions incorporate non-sample information to achieve an acceptable degree of conservatism. In the case of the QB bound, this conservatism is introduced through a special provision in the method for 100 percent overstatements, while in the case of the MT bound, this conservatism results from the inclusion of a single hypothetical error tainting.

The explicit sampling distributions of both methods provide considerable flexibility in constructing confidence intervals or testing hypotheses. For example, a two-sided classical confidence interval could be obtained, rather than just a one-sided upper confidence bound. However, in the papers in which these methods were presented, and in this paper, only the upper confidence bound is examined.

Another common characteristic of both methods is the way that understatement errors are used. Both methods make full use of such information by simultaneously taking into account all overstatement and understatement errors. Indeed, it is this ability which most clearly distinguishes these methods from earlier dollar-unit sampling methods. The "simultaneous" approach tends to lead to smaller confidence bounds than, for example, the Stringer bound offset approach of Meikle [1972].

In this paper we examine the reliability and compare the upper confidence bounds of the QB and MT methods using simulated accounts receivable and inventory populations. As is subsequently discussed, these populations were motivated by existing evidence about the nature of accounting errors. Although Dworin and Grimlund examined the reliability of the nominal confidence level of the MT bound in a series of simulation studies, the reliability of the nominal confidence level for the QB bound was not examined by McCray. We therefore provide (in sections 5 and 6) reliability results for the QB bound using a series of simulation studies similar to those previously used by Dworin and Grimlund.

Because of the computational requirements of the QB bound, we have limited our simulation studies to 96 separate populations, each of which were examined in 250 simulation trials. These results allow us to conclude that (like the MT method) the QB method is basically a reliable method of establishing an upper confidence bound for the range of accounting error distributions characterized by the 96 test populations. Having established that both methods are equally reliable over this range, we concern ourselves in the remainder of the paper with the relative magnitude of the bounds obtained from the two methods. For a given nominal confidence level and sample size we seek to determine the method which yields the smallest confidence bounds and thus minimizes the potential risk of rejecting accounts which are not materially in error.

We address this issue using a slightly *modified* version of the *moment* method, which we subsequently refer to as the MM method (or MM bound). As explained in section 3, the expression for the hypothetical error used in the original MT method has been slightly modified in the MM method. This modification only affects those cases where the average of the observed sample error taintings is negative. This modification eliminates some of the excess conservatism of the original MT method in special types of inventory populations without affecting the overall reliability of the method. As discussed in due course, it is offered in the same pragmatic (but empirically tested) spirit which led to the original specifications of the hypothetical error tainting.

An initial comparison of the QB and MT confidence bounds is presented in section 2 using the 49 tainting patterns discussed by McCray (for these examples the MM and MT methods give identical results). The resulting comparisons seem to imply that neither method's confidence bound is uniformly smaller than the other. However, given the special nature of these tainting patterns and the limited number of examples, such evidence is very inconclusive.

Indeed, given the ease with which the moment bound can be calculated, we expect that others, like us, will be inclined to do these same calculations, and like us, ponder upon the representativeness of the results. This has led us to the more extensive simulation studies, with a large variety of populations, as reported in sections 5 and 6. In spite of the statistical uncertainty associated with the use of 250 trials in each simulation study, a number of conclusions may be drawn from our study of nearly 24,000 simulated audit samples (250*96).

These simulation results indicate that the MM bound usually will be less than the QB bound for populations with low to moderate error rates (i.e., ≤six percent for accounts receivable, ≤20 percent for inventory accounts). For higher error rate populations with a true mean error that is either near zero or very large, the QB bound tends to be smaller than the MM bound. For the remainder of the populations of our study, both methods provided comparable bounds.

Of equal importance is our result that both methods provide a significant advantage over the Stringer bound without compromising the reliability of the desired confidence level (95 percent in our study). Thus, our results indicate that an auditor can incur a lower risk of rejecting an account that is not materially in error by using the QB or MM methods rather than the Stringer Method.

INITIAL COMPARISONS OF THE QB AND MT BOUNDS

McCray [1984] provided examples of the relative performance of the QB and multinomial methods at 95 percent (Table 5, p. 45) and 99 percent (Table 6, p. 46) confidence levels, for audit samples of 51, 101, or 201 dollar units. For these examples (all of which include only overstatement errors), the QB method yielded somewhat tighter confidence bounds than the multinomial method when there was a single observed error tainting, or when there were either several small error taintings or several large error taintings. In contrast, the multinomial method provided a somewhat tighter bound in the examples with observed error taintings that ranged over a broader spectrum of values (e.g., .25, .40, .60, .75).

As an initial step in our evaluation, we have computed confidence bounds with the MT method for the same set of error taintings, confidence levels, and sample sizes given by McCray in his Tables 5 and 6. The accounts receivable expression for the hypothetical error tainting (as reviewed in the next section) was used in cal-

TABLE 1

COMPARISON OF THE QUASI-BAYESIAN (QB) AND MOMENT BOUND (MT) CONFIDENCE BOUNDS FOR A 95 PERCENT CONFIDENCE LEVEL AND VARIOUS SAMPLE SIZES (N)
- TOTAL BOOK VALUE $1 MILLION, BOUNDS IN THOUSANDS OF DOLLARS

	$N=51$		$N=101$		$N=201$	
Errors	*QB*	*MT*	*QB*	*MT*	*QB*	*MT*
1	55.2	51.5	28.8	26.6	14.7	13.5
5	55.8	39.6	28.9	20.5	14.7	10.4
25	57.2	29.8	29.6	15.4	15.1	7.9
50	60.3	43.5	31.2	22.6	15.9	11.5
75	67.7	58.7	35.1	30.4	17.9	15.5
95	83.1	71.0	43.1	36.8	22.0	18.7
99	86.6	73.5	45.0	38.1	22.9	19.4
100	87.5	74.1	45.4	38.4	23.1	19.5
1,95	83.3	67.9	43.2	35.2	22.0	17.9
25,75	72.0	64.4	37.3	33.4	19.0	17.0
25,25	60.3	38.4	31.2	20.0	15.9	10.2
30,40	63.1	47.6	32.6	24.8	16.6	12.6
50,50	68.7	62.0	35.6	32.3	18.1	16.5
75,90	96.6	94.6	50.2	49.2	25.6	25.1
75,75	86.9	86.9	45.2	45.2	23.1	23.0
100,100	115.7	112.0	60.2	58.2	30.7	29.7
25,25,25	63.9	46.3	33.1	24.2	16.8	12.4
50,50,50	78.3	78.2	40.6	40.8	20.7	20.9
75,75,75	106.4	111.4	55.5	58.1	28.3	29.7
100,100,100	141.9	144.8	74.0	75.5	37.8	38.6
1,2,3,4	56.4	51.9	29.2	26.8	14.8	13.6
1,40,60,99	106.4	99.7	53.3	52.0	28.3	26.6
25,40,60,75	92.9	95.2	48.4	49.7	24.7	25.4
50,50,50,50	88.6	93.1	46.0	48.7	23.5	24.9
96,97,98,99	162.8	170.8	85.1	89.3	43.5	45.7
25,25,25,25	67.9	53.7	35.1	28.1	17.9	14.4
75,75,75,75	125.1	133.9	65.4	70.0	33.4	35.8
100,100,100,100	167.0	174.9	87.2	91.4	44.6	46.8

culating the MT bound, since the error taintings in these examples are more representative of accounts receivable populations than inventory populations. For these taintings, the MT and MM bounds are identical.

The QB and MT bounds for these examples are shown in Tables 1 and 2. As may be seen from these tables, the MT method uniformly provided a tighter confidence bound than the QB method when one or two error taintings were used. For three or four error taintings, the MT method continued to provide a tighter bound than the QB method when small error taintings were used. However, the QB method provided a tighter bound when larger (e.g., .75) error taintings were observed. The relative performance of the two methods is also seen to be invariant with respect to the audit sample size or confidence level. The nonmonotonic behavior of the moment bound for one or two small error taintings, as discussed in Dworin and Grimlund [1984, p. 224], is also evident in these tables.[2]

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[2] This nonmonotonic behavior of the MM bound, which may arise with one or two small errors, is clearly an aesthetically displeasing feature of the method. It results from the specification of the hypothetical error tainting

TABLE 2

COMPARISON OF THE QUASI-BAYESIAN (QB) AND MOMENT BOUND (MT) CONFIDENCE BOUNDS FOR A 99 PERCENT CONFIDENCE LEVEL AND VARIOUS SAMPLE SIZE (N)
BOOK VALUE $1 MILLION, CONFIDENCE BOUNDS IN THOUSANDS OF DOLLARS

	$N=51$		$N=101$		$N=201$	
Errors	*QB*	*MT*	*QB*	*MT*	*QB*	*MT*
1	84.0	78.1	44.0	40.5	22.5	20.6
5	84.6	59.7	44.1	31.0	22.5	15.8
25	85.9	43.4	44.8	22.7	22.9	11.6
50	88.9	63.8	46.4	33.3	23.7	17.0
75	96.1	86.6	50.2	45.1	25.7	23.1
95	114.4	105.3	59.9	54.8	30.7	28.0
99	119.3	109.1	62.4	56.8	32.0	29.0
100	120.5	110.0	63.1	57.3	32.3	29.2
1,95	114.6	97.8	60.0	50.9	30.7	26.0
25,75	100.2	90.6	52.4	47.4	26.8	24.2
25,25	88.9	53.2	46.3	27.9	23.7	14.3
30,40	91.6	65.9	47.8	34.6	24.4	17.7
50,50	97.1	86.0	50.7	45.1	25.9	23.1
75,90	127.1	131.9	66.7	69.1	34.2	35.4
75,75	114.9	127.0	60.3	63.4	30.9	32.5
100,100	151.5	156.5	79.6	81.9	40.8	41.9
25,25,25	92.5	61.9	48.2	32.6	24.7	16.7
50,50,50	106.4	104.6	55.7	55.1	28.5	28.3
75,75,75	135.2	149.5	71.2	78.7	36.6	40.4
100,100,100	180.0	194.8	94.9	102.4	48.7	52.6
1,2,3,4	85.2	74.4	44.4	38.5	22.7	19.6
1,40,60,99	139.0	133.1	73.0	69.9	37.4	35.8
25,40,60,75	120.6	125.1	63.3	66.0	32.4	33.9
50,50,50,50	116.3	121.4	60.9	64.2	31.2	33.0
96,97,98,99	201.7	223.4	106.6	118.0	54.9	60.6
25,25,25,25	96.3	70.0	50.2	37.0	25.7	19.0
75,75,75,75	155.1	174.9	82.0	92.4	42.2	47.5
100,100,100,100	206.9	228.8	109.3	120.8	56.3	62.1

McCray also calculated the QB and multinomial bounds for 21 different tainting patterns having both overstatement and understatement errors (Table 7, p. 47). For each of these 21 examples we have computed the corresponding MT bound. In Table 3 these bounds are compared with the QB bounds for a sample size of 100 and a nominal 95 percent confidence level. The 21 examples chosen by McCray are of two types. The first ten examples have matched pairs of understatement and overstatement errors. In the remaining 11 examples, there are more overstatement errors than understatement errors. As may be seen from Table 3, the QB method provided a tighter confidence bound than the MT method (even when the in-

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which is introduced to build a level of conservatism into the method. However, since the auditor's focus is on accepting or rejecting accounting populations (rather than on just estimating the amount in error), we are not convinced that this nonmonotonic behavior is of any serious consequence. Our simulation studies indicate that the MT and MM bounds are very conservative at low error rates in spite of this anomalous behavior. It should be noted that similar anomalies arise with the multinomial and QB bounds (e.g., examples 1 to 6 of McCray's Table 7 [1984, pp. 47]).

TABLE 3

COMPARISON OF THE QUASI-BAYESIAN (QB) AND MOMENT BOUND (MT) METHOD CONFIDENCE BOUNDS FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100
BOOK VALUE $1 MILLION, CONFIDENCE BOUNDS IN DOLLARS

Ex.	*Errors*	*QB*	*MT (A.R.)*	*MT (INV)*
1 US:	10			
OS:	10	27,077	29,105	25,757
2 US:	10,10,10,10,10			
OS:	10,10,10,10,10	25,751	36,148	24,425
3 US:	25,25,25			
OS:	25,25,25	24,022	34,886	26,937
4 US:	25,25,25,25,25			
OS:	25,25,25,25,25	23,828	38,836	28,146
5 US:	50			
OS:	50	23,418	32,403	29,393
6 US:	50,50,50			
OS:	50,50,50	25,452	40,474	33,664
7 US:	50,50,50,50,50,50			
OS:	50,50,50,50,50,50	28,948	49,273	39,999
8 US:	75,75,75,75,75			
OS:	75,75,75,75,75	42,422	57,106	49,548
9 US:	100			
OS:	100	33,115	40,272	37,746
10 US:	100,100,100			
OS:	100,100,100	46,553	56,500	51,212
11 US:	40,25			
OS:	25,40,60,75	42,114	41,540	39,839
12 US:	75			
OS:	25,40,60,75	40,515	42,002	40,567
13 US:	10			
OS:	10,20,30,40,50	39,238	36,269	34,339
14 US:	20			
OS:	10,20,30,40,50	37,951	35,261	33,310
15 US:	30			
OS:	10,20,30,40,50	36,569	34,437	32,457
16 US:	40			
OS:	10,20,30,40,50	35,173	33,796	31,773
17 US:	50			
OS:	10,20,30,40,50	33,805	33,336	31,248
18 US:	60			
OS:	10,20,30,40,50	32,482	33,066	30,881
19 US:	70			
OS:	10,20,30,40,50	31,219	33,003	30,676
20 US:	80			
OS:	10,20,30,40,50	30,006	33,176	30,650
21 US:	90			
OS:	10,20,30,40,50	28,855	33,626	30,829

ventory form of hypothetical error tainting is used) in eight of the ten examples where matched understatements and overstatements are present. However, in the 11 examples where the overstatement errors dominate, the inventory form of the MT method yielded a tighter bound than the QB method in all but three of the examples. Further, the accounts receivable form of the MT bound is tighter in six of the 11 examples.

Because of the limited number and unique characteristics of McCray's tainting patterns, it is difficult to draw any general conclusions from the results in this section. At best, all one can really conclude from these examples (with their somewhat artificial choice of error taintings) is that neither method uniformly dominates the other, and (perhaps) that the MT method gives lower confidence bounds in situations more likely to be encountered in auditing practice. Since we feel that the data of this section will be of interest to many readers, we have included these results. However, an extensive simulation study is required in order to draw any definitive conclusions as to the relative performance of the quasi-Bayesian and moment methods.

THE MODIFIED MOMENT (MM) BOUND

Before turning to the simulation studies, it is necessary to discuss briefly the modification to the original Dworin and Grimlund procedure. The hypothetical error tainting was introduced in the original Dworin and Grimlund work in order to deal with cases where a very small number of large overstatement error taintings might be present in the accounting population. To compensate for the possibility that none of these error taintings might actually be observed in the audit sample, Dworin and Grimlund suggested adding a single hypothetical error tainting to the actual error taintings observed.

It should be noted that the inclusion of such an error tainting did not arise from application of classical statistical theory, but rather was suggested as a mathematical method of providing an adequate level of conservatism. More recently, several other approaches to dollar-unit sampling have used comparable approaches. Thus, Godfrey and Neter [1984], Menzefricke and Smieliauskas [1984], and Tsui, Matsumura, and Tsui [1985] all use fixed Bayesian prior distributions (i.e., specified by the authors) as a way of striving to achieve a conservative bound. Although the Bayesian mathematical framework of these studies differs from the more classical mathematics of Dworin and Grimlund, the underlying rationale of all these studies is the same. In each case a mathematical (but empirically tested) artifice is used to incorporate a degree of conservatism into the calculation of the confidence bound.

The single hypothetical error of the Dworin and Grimlund approach was sufficient to ensure the reliability of the nominal confidence level of the MT method in the variety of populations that they tested. As the error rate increases, the greater number of observed error taintings generally tends to reduce the significance of this single hypothetical error. However, if equal pairing of understatement and overstatement errors is observed, the effect of the single error tainting does not decline, despite the larger number of actual error taintings. This was the case with the first ten examples of Table 3.

For accounts receivable populations, where overstatement errors generally dominate any understatement errors, the magnitude of the hypothetical error tainting could not be significantly reduced without also significantly reducing the reliability of the moment method. However, from the results shown in Dworin and Grimlund for the performance of the

TABLE 4

COVERAGE STATISTICS FOR THE MOMENT BOUND (MT), THE MODIFIED MOMENT BOUND (MM), AND THE REDUCTION IN AVERAGE COVERAGE (IN PERCENT)

	Model 1	*Model 2*	*Model 3*	*Model 4*
Accounts Receivable:				
Average Coverage (MT)	99.7	99.0	97.7	96.5
Average Coverage (MM)	99.5	98.3	97.2	95.9
Reduction	.2	.7	.5	.6
Inventory:				
Average Coverage (MT)	99.5	98.6	97.3	96.2
Average Coverage (MM)	98.0	97.2	96.2	95.0
Reduction	1.5	1.4	1.1	1.2

MT method when applied to inventory accounts (Table 7, pp. 233–4), it appears that the MT method is somewhat too conservative in those cases where the number of understatement errors tends to equal or exceed the number of overstatement errors. This excessive conservatism can be somewhat reduced by modifying the magnitude of the hypothetical error tainting, t^*, for cases where the average observed error tainting is negative.

Consider the expression for the hypothetical error tainting given in Dworin and Grimlund (Table 1, Eq. 1, p. 222):

$$t^* = .81[1 - .667 \tanh(10\bar{t})] \times [1 + .667 \tanh(n/10)], \quad (1)$$

where tanh (x) is the hyperbolic tangent of x, $\bar{t}$ is the average value of the observed error taintings, n is the number of such taintings, and for inventory accounts the second bracketed term is not used. Rather than have the magnitude of t^* increase when an audit sample contains understatement errors such that $\bar{t}<0$, Dworin and Grimlund suggested that $\bar{t}$ be set equal to zero in such cases. If, however, this procedure is modified so that in all cases the absolute value of $\bar{t}$ is instead used in Eq. (1), the resulting value of t^* would in fact decline with $\bar{t}$ for $\bar{t}<0$ (rather than t^* having a constant value when $\bar{t}\leq 0$). This use of the absolute value of $\bar{t}$ in Eq. (1) is the only difference between the MM and the original MT method. It appears to be a reasonable modification of the original approach that will better utilize the available sample information in constructing a conservative bound.

Since relatively few of the accounts receivable simulation studies considered by Dworin and Grimlund were likely to involve trials where $\bar{t}<0$, the reliability of the MM method for these populations should not be significantly reduced from that observed with the MT method. Even for inventory accounts, where there is a greater chance of obtaining an audit sample for which $\bar{t}<0$, any reduction in the "coverage" of the MM method should be modest, and the method should continue to be reliable. However, to be sure that this is true, we have replicated all of the inventory and accounts receivable simulation studies of Dworin and Grimlund. The summary statistics for the original MT method and for the MM method are shown in Table 4. As may be seen from this table, the suggested modification has only a negligible effect on the reliability

TABLE 5

COMPARISON OF THE QUASI-BAYESIAN (QB), MOMENT (MT), AND MODIFIED MOMENT (MM) CONFIDENCE BOUNDS, FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100 BOOK VALUE $1 MILLION, CONFIDENCE BOUNDS IN THOUSANDS OF DOLLARS

Ex.	*Errors*	*TBAR*	*QB*	*MT*	*MM*
1 US:	61,54,46,11				
OS:	42,47,76	− 1.0	27.86	34.59	33.34
2 US:	93,45,38,17				
OS:	22,37,50,54	− 3.8	22.16	31.63	27.58
3 US:	117,69,40,37				
OS:	30,32,35,47,79	− 4.4	28.09	36.12	32.06
4 US:	64,30				
OS:	25,50	− 4.8	21.47	27.81	22.23
5 US:	97,61,51,35				
OS:	14,16,32,38,98	− 5.1	30.57	34.90	32.47
6 US:	128,78,49,46,35,23				
OS:	33,50,81,88	−10.7	29.35	34.20	27.64
7 US:	84,61,45,37,28				
OS:	38,88	−18.4	18.81	23.78	15.39
8 US:	127,81,56,34,27				
OS:	26,41,53	−25.6	7.74	18.02	9.91
9 US:	95,46,41,40,31				
OS:	10,11,26	−25.8	2.35	11.53	2.45
10 US:	100,73,69,58,56,23,23				
OS:	35,49	−35.3	−5.17	7.67	.05

of the confidence bound for the distributions previously examined by Dworin and Grimlund.

Since $\bar{t}$ is not negative in any of the examples in Tables 1, 2, and 3, the relative performance of the QB and MM methods for these examples is exactly the same as that noted for the QB and MT methods. To illustrate the comparative performance of the QB, MT, and MM methods we must choose examples where $\bar{t}<0$. In Table 5 we provide ten examples where this modification to the moment method has an effect.

We use these examples to illustrate two points. First, we wish to emphasize the fact that this modification provides only a moderate (though welcome) improvement on the performance of the moment bound. It does not mitigate the general advantage of the QB bound in situations where the understatement errors are comparable to, or dominate, the overstatement errors. Second, as noted in the next section, we use these examples to exhibit the advantage of using simulation studies over inference by example.

Each example lists the nonzero error taintings "observed" in a random sample of 100 dollar units chosen from a simulated accounting population with a mean error of zero. This population is characterized by a ten percent total error rate, and a symmetric bimodal error tainting distribution with peaks at −.50 and +.50. We took 40 random samples, each of which had 100 individual dollar units, from this distribution. We eliminated all samples with $\bar{t}>0$, and then, as a matter of convenience, selected from the remaining samples the ten with the lowest number of taintings. As expected, Table 5 shows that the difference between the MM and MT confidence bounds increases as $\bar{t}$ (TBAR) becomes increasingly negative due to the presence of more (or larger) understatement errors. The QB bound, which is tighter than the MM bound in eight of the ten examples, is also provided in Table 5.

THE USEFULNESS OF SIMULATION STUDIES

One of the ten QB bounds for the total error in the above example is negative, and consequently less than the true mean error of zero. The resulting ten percent failure rate of the QB bound is misleading but not surprising, since our selection procedure was biased towards selecting examples with lower confidence bounds. In contrast, a special simulation study that we conducted showed that the QB method gives quite reliable results for this bimodal error tainting distribution. This is an illustration of the advantage of using simulation studies to avoid the pitfalls of drawing conclusions from capricious examples.

Such a series of simulation studies must, of course, make use of a very extensive and representative set of populations. McCray, for instance, states [1984, pp. 42] that simulation studies were not performed in his analyses of the QB method because

> one should not conclude after satisfactory testing with, say ten or 20 different populations, that a model is a good approximation to an upper confidence limit. Such a conclusion could be justified only by assuming that all populations an auditor examines will be similar to the ten or 20 tested.

We agree that simulation studies that were carried out over such a narrow range of populations would not be very meaningful. However, our examination of the performance of the QB and MM bounds over the range of possibilities represented by our 96 test populations should reduce such concern. Further, as subsequently discussed in this paper and in Dworin and Grimlund [1984], our range of populations is based on the distribution of accounting errors which the existing literature indicates is actually observed in practice. It is, of course, possible that an auditor might encounter an accounting population well outside of this range. In such a case, the results of our simulation studies are not directly applicable. However, if the characteristics of the observed error taintings differ significantly from those of our test populations, the auditor should, in most cases, be able to recognize this and take appropriate action. We cannot, of course, rule out the possibility of a seemingly appropriate (but nonrepresentative) sample being drawn from an unusual population. In summary, as long as simulation studies are conducted using a well defined set of test populations, and this set is representative of accounting populations expected in practice, the simulation studies will yield valuable results.

SIMULATION STUDIES FOR ACCOUNTS RECEIVABLE

Simulation studies of the QB method using the same number of accounts receivable accounting populations (and the same number of trials per study) as employed by Dworin and Grimlund would entail prohibitive computational costs. Consequently, we have chosen a representative subset of only 54 of their 108 accounts receivable populations. In their paper, the different accounting populations were described in terms of five independent parameters: the overall error rate, the fraction of all errors that are non-100 percent overstatement errors, the fraction of all errors that are 100 percent overstatement errors, and two parameters used to specify the understatement and (non-100 percent) overstatement error tainting distributions. The latter two parameters were used to define four different error tainting "models" while the first three parameters were used to define 27 different "cases." The 108 different populations of their paper were then obtained from all 4×27 combinations of models and cases.

For the present paper we used all 27 of their cases but only two of their four error tainting models. This led to 54 studies. As shown in Tables 6(a) and 6(b), for a 95 percent nominal confidence level the overall error rate of these studies ranges from three percent to ten percent, the percentage of error taintings represented by non-100 percent overstatement errors ranges from 60 percent to 100 percent, and the percentage of error taintings represented by 100 percent overstatement ranges from zero percent to 20 percent. As indicated in Tables 6(a) and 6(b), models 1 and 3 of the Dworin and Grimlund study were used with each of the 27 cases. These models were based on the error tainting patterns used by Leitch, et al. [1982].

Model 2 of the Dworin and Grimlund study was not used in the current study because the distribution of both the non-100 percent overstatement errors and the understatement errors is intermediate between those of models 1 and 3. Model 4, which was included in the Dworin and Grimlund study as a worst-case example, was also excluded from the present study. New evidence on the nature of tainting patterns from a recent study by Neter, Johnson, and Leitch [1984] provides support for our decision to not include model 4. This evidence suggests even tighter error tainting patterns than previously suspected. While models 2 and 4 were not essential to the prior study, they were included (at insignificant marginal cost) as extra data. In the current study the calculation costs associated with the QB method precluded their inclusion here.

For each of the 54 studies shown in Tables 6(a) and 6(b), an audit sample of 100 random dollar units was repeatedly drawn 250 times in accordance with the case and model parameters of the particular study. The actual mean error (as a percent of book value) corresponding to the specified error distribution is shown in the column labeled "Act. Error" for each of the studies. Table 5 of Dworin and Grimlund [1984] shows how these values are calculated.

The QB and MM upper confidence bounds were calculated for the specific error taintings "observed" in each of the 250 "trials." To examine the reliability of the 95 percent nominal confidence level, a "coverage" statistic then was computed for each method. This is the percentage of trials for which the computed confidence bound exceeded the actual mean error tainting of the study's population (as determined from the known case and model parameters). The "QB Cover." and "MM Cover." columns of Tables 6(a) and 6(b) give these coverage statistics. These coverage statistics would approximate the actual coverage of the QB and MM bounds for each population at a 95 percent nominal confidence level if the number of trials used in each simulation study was quite large. However, as expanded upon in due course, with our use of 250 trials per study there will be random fluctuations embedded in these results.

Tables 6(a) and 6(b) show that the QB bound is very conservative when applied to accounts receivable populations. In particular, despite the desired 95 percent nominal confidence level, the average

TABLE 6(A)

RESULTS[1] OF THE SIMULATION STUDIES OF THE QUASI-BAYESIAN (QB) AND MODIFIED MOMENT BOUND (MM), FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100, FOR ACCOUNTS RECEIVABLE, MODEL 1[2]

Case	*Over* %	*Under* %	*100* %	*Actual Error*	*Good Trial*	*QB Cover.*	*MM Cover.*	*QB Low*	*QB Advan.*	*MM Advan.*	*Extra Advan.*
3%											
1	100	0	0	.30	250	100	100	3.60	11.37	30.93	19.56
2	90	0	10	.57	250	100	100	3.20	9.19	28.88	19.69
3	80	0	20	.84	250	100	100	4.40	7.66	25.41	17.75
4	90	10	0	.24	247	100	100	6.88	12.41	31.32	18.91
5	80	10	10	.51	248	100	100	6.45	9.82	28.35	18.53
6	70	10	20	.78	245	100	99.2	7.35	8.27	25.12	16.85
7	80	20	0	.18	246	100	100	9.76	13.38	30.66	17.28
8	70	20	10	.45	243	100	100	9.05	11.12	28.47	17.35
9	60	20	20	.72	237	100	99.6	8.02	9.42	26.22	16.80
6%											
10	100	0	0	.60	250	100	100	1.20	15.75	30.22	14.47
11	90	0	10	1.14	250	100	100	2.80	10.94	25.13	14.19
12	80	0	20	1.68	250	100	98.4	1.20	8.22	20.72	12.50
13	90	10	0	.48	248	100	100	14.52	17.41	28.56	11.15
14	80	10	10	1.02	247	100	100	4.86	11.85	24.81	12.96
15	70	10	20	1.56	247	100	99.6	3.64	9.43	21.12	11.69
16	80	20	0	.36	241	100	100	23.65	19.33	27.73	8.40
17	70	20	10	.90	245	100	98.8	11.02	13.66	25.62	11.96
18	60	20	20	1.44	248	100	100	9.68	10.30	20.90	10.60
10%											
19	100	0	0	1.00	250	100	100	6.00	18.90	26.91	8.01
20	90	0	10	1.90	250	100	100	1.60	11.02	20.21	9.19
21	80	0	20	2.80	250	100	94.8	3.20	7.79	15.00	7.21
22	90	10	0	.80	250	100	100	24.00	21.70	25.15	3.45
23	80	10	10	1.70	250	100	100	7.60	12.65	20.75	8.10
24	70	10	20	2.60	249	99.6	97.6	6.02	8.84	15.26	6.42
25	80	20	0	.60	248	100	100	45.16	24.29	22.46	−1.83
26	70	20	10	1.50	250	100	99.6	20.80	14.17	20.41	6.24
27	60	20	20	2.40	249	98.0	97.2	6.83	10.20	17.26	7.06
Average values					247.7	99.9	99.4	9.35	12.56	24.58	12.02

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[1] All numbers shown, except for the Good Trials, are percentages.

[2] The understatement and (non-100 percent) overstatement error taintings in Model 1 are represented by a chi-square distribution function with one degree of freedom and a mean value of .1.

TABLE 6(B)

RESULTS[1] OF THE SIMULATION STUDIES OF THE QUASI-BAYESIAN (QB) AND MODIFIED MOMENT BOUND (MM), FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100, FOR ACCOUNTS RECEIVABLE, MODEL 3[2]

Case	Over %	Under %	100 %	Actual Error	Good Trial	QB Cover.	MM Cover.	QB Low	QB Advan.	MM Advan.	Extra Advan.
3%											
1	100	0	0	.90	250	100	100	9.20	17.09	32.75	15.66
2	90	0	10	1.11	250	100	100	7.20	14.22	29.05	14.83
3	80	0	20	1.32	250	100	100	9.60	11.97	25.07	13.10
4	90	10	0	.78	249	100	99.2	8.43	17.66	33.67	16.01
5	80	10	10	.99	249	100	99.6	7.63	14.69	29.74	15.05
6	70	10	20	1.20	244	100	98.8	9.02	12.19	24.41	12.22
7	80	20	0	.66	245	100	100	10.20	18.56	34.07	15.51
8	70	20	10	.87	242	100	99.6	8.26	15.38	30.54	15.16
9	60	20	20	1.08	239	100	99.2	9.62	12.22	26.47	14.25
6%											
10	100	0	0	1.80	250	100	97.6	19.60	20.06	26.01	5.95
11	90	0	10	2.22	250	100	95.2	17.20	15.06	20.63	5.57
12	80	0	20	2.64	250	100	91.2	20.00	12.06	16.81	4.75
13	90	10	0	1.56	248	100	98.4	16.13	21.28	27.77	6.49
14	80	10	10	1.98	247	100	96.8	12.96	15.77	22.23	6.46
15	70	10	20	2.40	248	99.6	93.6	15.32	12.50	18.56	6.06
16	80	20	0	1.32	242	100	100	18.60	22.32	28.76	6.44
17	70	20	10	1.74	244	99.6	97.1	15.16	16.61	23.44	6.83
18	60	20	20	2.16	249	99.2	92.4	14.06	13.08	19.50	6.42
10%											
19	100	0	0	3.00	250	100	96.4	56.80	19.69	19.41	−.28
20	90	0	10	3.70	250	96.0	92.4	43.60	14.01	14.34	.33
21	80	0	20	4.40	250	95.2	94.4	46.40	10.80	10.76	−.04
22	90	10	0	2.60	250	99.2	98.4	47.20	21.33	21.81	.48
23	80	10	10	3.30	250	99.2	94.0	30.80	14.89	16.56	1.67
24	70	10	20	4.00	250	96.0	93.2	39.60	11.45	12.46	1.01
25	80	20	0	2.20	250	100	99.6	38.00	23.25	24.41	1.16
26	70	20	10	2.90	249	98.8	97.6	30.12	16.14	18.37	2.23
27	60	20	20	3.60	250	96.0	94.4	24.40	12.35	14.64	2.29
Average Values:					248.0	99.21	97.0	21.67	15.80	23.08	7.24

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[1] All numbers shown, except for the Good Trials, are percentages.

[2] The understatement error taintings in Model 3 are represented by a chi-square distribution function with one degree of freedom and a mean value of .1, while the (non-100 percent) overstatement error taintings are represented by a chi-square distribution function with three degrees of freedom and a mean value of .3.

coverage of this method in the two tables is very close to 100 percent. Only in two studies (cases 24 and 27) did the coverage for model 1 drop below 100 percent. Even for model 3, with larger errors, the QB coverage only approached the nominal 95 percent level for one study (case 21).

The coverage of the MM bound shown in Table 6(a) for model 1 is also quite high. However, the MM coverage in Table 6(b) for model 3 falls below 95 percent in eight of the 27 cases. For these eight model 3 cases, the average MM coverage is 93.2 percent, although the average MM coverage over all 27 cases for model 3 is 97.0 percent. In only one of these eight cases (case 12) is the coverage statistic (91.2 percent) below a critical value of 92.3 percent.[3] Thus, only for case 12 would the hypothesis that the MM method is reliable (i.e., provides at least the nominal 95 percent coverage) have to be rejected at the five percent significance level.[4]

The "QB low" statistics of Tables 6(a) and 6(b) provide one measure of the relative performance of the QB and MM methods. The "QB low" statistic shows the percentage of trials in which the QB bound was tighter than the MM bound. From the very low value of this statistic it can be seen that the MM bound was (with high statistical significance) tighter than the QB bound in three percent and six percent error rate cases. At a ten percent error rate, the MM bound was not statistically tighter than the QB bound in four of the 18 cases (Case 25 in Table 6(a), and Cases 19, 21, and 22 in Table 6(b)).[5]

The frequency with which the QB bound is tighter than the MM bound is clearly seen to increase as the average size of the non-100 percent overstatement errors increases. In model 1, where the mean tainting of the non-100 percent overstatement errors was .1, the QB bound was lower in 9.4 percent of the trials. However, for model 3, where the mean tainting for the non-100 percent overstatement errors was .3, the QB bound was lower in 21.7 percent of the trials.

The relative advantage of each bound with respect to the Stringer bound provides another, more quantitative, measure of the relative performance of the two methods. These "advantage" statistics are also given in Tables 6(a) and 6(b). It may be seen from the tables that both methods provide tighter bounds than the Stringer bound.[6] On average, for both models 1 and 2, the QB bound is 14.2 percent tighter than the Stringer bound, while the MM bound is 23.8 percent tighter. For each study the difference of these two "advantages" is shown in a separate column giving the MM bound's "extra advantage." The MM bounds's "extra advantage" (over the QB bound) is on average 12.0 percent (of the Stringer bound) for model 1, 7.2 percent for model 3, and 9.7 percent over both models.[7]

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[3] As shown by Table 3.3 of Cochran [1963], at our sample size and error rates it is not appropriate to use a normal approximation to the sampling distribution for a proportion. We have used a more accurate three-moment gamma approximation based upon the mathematics of Dworin and Grimlund [1984]. As shown in the appendix, this leads to a critical value of 92.33 percent for rejection (at the five percent significance level) of the hypothesis that the actual coverage is 95 percent or greater.

[4] A much more stringent test is to require the rejection of the converse hypothesis that "these methods are not reliable" (i.e., provide less than 95 percent coverage). To reject such a hypothesis, the observed coverage for the 250 trials would have to exceed a critical value of 96.9 percent (at a five percent significance level). This was indeed observed for most of the studies with the QB method. Consequently, it may be regarded as an unambiguously conservative method when applied to accounts receivable. This same hypothesis can be rejected for all but one of the model 1 studies of the MM method. However, it can not be rejected for 11 of the 27 model 3 MM studies.

[5] As shown in the appendix, with 250 trials per simulation study, we can reject the hypothesis that "on average the QB bound is tighter than the MM bound (i.e., the QB bound is lower than the MM bound in 50 percent or more of the trials)" when the "QB low" statistic is less than 44.8 percent.

[6] We have used a slightly different procedure for calculating the advantage statistics from that previously used in Dworin and Grimlund. They calculated the average advantage as the average of the trial by trial ratios of the MT and Stringer bounds. In this paper, the average advantage of the MM (or QB) bound over the Stringer bound is defined as the ratio of the average MM (or QB) bound to the average Stringer bound. This procedure has been used to accommodate the special characteristics of several inventory populations with a mean population error of zero which were not included in the prior study. For the remaining populations the two definitions of the advantage statistics yield nearly identical values.

The MM bound's largest "extra advantages" are seen to occur in studies with small error rates and error sizes. As the error rate and error size increase, the magnitude of the "extra advantage" of the MM method decreases. With larger errors (e.g., model 3) and a ten percent error rate, the magnitude and sign of the "extra advantage" are small and varying. Thus, for these higher error rate cases, both methods would appear to provide comparable improvement over the Stringer method.

In Tables 6(a) and 6(b), a "good trials" column is also included. This reflects the fact that the algorithm for calculating the QB bound failed to converge properly in 117 out of the 13,500 accounts receivable trials (i.e., a 0.87 percent failure rate). Most likely, the calculating difficulty with these trials can be remedied on an individual basis by repeatedly adjusting the controlling numerical parameters of the QB method. However, such special steps were not attempted with our automated simulation procedures since the number of failures in any one study was not large enough to significantly change the observed results. Consequently, the percentages given in Tables 6(a) and 6(b) (and in all subsequent tables) are based upon the indicated number of "good trials."

In the process of doing the rather elaborate and complex QB calculations for the 95 percent QB confidence bound, it is also possible to determine confidence bounds at other confidence levels without a significant increase in computer time. Consequently, tables similar to Tables 6(a) and 6(b) have been prepared for the 99 percent, 90 percent, and 80 percent confidence levels. These tables are available from the authors. While the results in these tables are generally similar to the results shown in Tables 6(a) and 6(b), these supplementary tables show that the relative advantage in model 1 of the MM method decreases modestly as the nominal confidence level decreases. For example, the average extra advantage of the MM bound in model 1 goes from 14.88 percent to 8.61 percent as the nominal confidence level decreases from 99 percent to 80 percent. In model 3 the decline in extra advantage is insignificant (i.e., from 8.54 percent to 7.00 percent).

SIMULATION STUDIES FOR INVENTORY ACCOUNTS

As was the case in our accounts receivable studies, the computational requirements of the QB method preclude our examining the relative performance of the QB and MM methods over as many representative inventory populations as reported in Dworin and Grimlund. We have instead performed 24 simulation studies using their model 1, and 18 studies using their model 2. In view of the QB method's computational requirements (especially for trials with a large number of error taintings), we feel that their models 3 and 4 are not sufficiently reflective of current evidence about actual inventory populations (e.g., Neter, Johnson, and Leitch [1984]) to warrant inclusion in the current study.

The results of these simulation studies are presented in Tables 7(a) and 7(b) using

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[7] Given that neither the QB nor the MM bound is currently being used in practice, we feel that these Stringer bound-denominated "extra advantage" statistics are more relevant than a direct comparison of the two bounds.

TABLE 7(A)

RESULTS[1] OF THE SIMULATION STUDIES OF THE QUASI-BAYESIAN (QB) AND MODIFIED MOMENT BOUND (MM), FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100, FOR INVENTORY ACCOUNTS, MODEL 2[2]

Case	*Over* %	*Under* %	*100* %	*Actual Error*	*Good Trial*	*QB Cover.*	*MM Cover.*	*QB Low*	*QB Advan.*	*MM Advan.*	*Extra Advan.*
10%											
1	80	20	0	.60	249	100	100	8.03	24.26	38.79	14.53
2	50	50	0	.00	248	100	100	7.66	33.28	45.33	12.05
3	20	80	0	−.60	250	100	100	4.80	43.13	61.21	18.08
4	75	20	5	1.05	249	99.6	99.2	3.21	18.11	32.93	14.82
5	45	50	5	.45	250	99.6	99.2	8.00	25.20	38.43	13.23
6	15	80	5	−.15	250	99.6	99.6	3.20	32.29	48.42	16.13
20%											
7	80	20	0	1.20	250	100	100	16.40	30.14	36.88	6.74
8	50	50	0	.00	250	100	100	37.20	46.02	48.11	2.09
9	20	80	0	−1.20	250	99.6	99.6	15.60	66.30	75.42	9.12
10	75	20	5	2.10	250	99.6	100	6.00	19.68	28.91	9.23
11	45	50	5	.90	250	99.8	95.6	14.00	29.71	36.82	7.11
12	15	80	5	−.30	250	98.0	96.8	4.00	41.23	50.26	9.03
40%											
13	80	20	0	2.40	250	98.8	99.6	36.00	33.52	34.59	1.07
14	50	50	0	.00	250	98.8	98.8	86.80	57.85	53.27	−4.58
15	20	80	0	−2.40	250	97.2	98.4	54.00	99.49	98.89	−.60
16	75	20	5	4.20	250	94.8	94.8	7.20	20.21	25.69	5.48
17	45	50	5	1.80	250	90.8	93.6	16.40	33.87	37.81	3.94
18	15	80	5	−.60	250	94.4	92.4	8.40	52.50	56.58	4.08
19	70	20	10	6.00	250	96.0	93.6	.80	15.07	20.17	5.10
20	45	45	10	4.00	250	96.0	95.6	2.80	22.71	27.67	4.96
21	20	70	10	2.00	250	96.8	96.4	1.60	32.34	36.90	4.56
60%											
22	75	20	5	6.30	250	95.6	95.2	4.00	19.97	24.13	4.16
23	45	50	5	2.70	250	96.4	97.2	16.40	35.26	38.02	2.76
24	15	80	5	−.90	250	95.6	95.2	6.00	58.11	60.66	2.55
Average value:					249.8	97.8	97.5	15.35	37.09	44.00	6.90

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[1] All numbers shown, except for the Good Trials, are percentages.

[2] The understatement and (non-100 percent) overstatement error taintings in Model 1 are represented by a chi-square distribution function with one degree of freedom and a mean value of .1.

TABLE 7(B)

RESULTS[1] OF THE SIMULATION STUDIES OF THE QUASI-BAYESIAN (QB) AND MODIFIED MOMENT BOUND (MM), FOR A 95 PERCENT CONFIDENCE LEVEL AND SAMPLE SIZE OF 100, FOR INVENTORY ACCOUNTS, MODEL 2[2]

Case	*Over* %	*Under* %	*100* %	*Actual Error*	*Good Trial*	*QB Cover.*	*MM Cover.*	*QB Low*	*QB Advan.*	*MM Advan.*	*Extra Advan.*
10%											
1	80	20	0	1.20	250	100	99.2	15.60	29.92	37.09	7.17
2	50	50	0	.00	250	99.6	99.2	24.00	44.18	50.24	6.06
3	20	80	0	−1.20	250	99.6	100	18.00	64.52	75.74	11.22
4	75	20	5	1.60	249	98.8	98.0	11.65	23.85	31.86	8.01
5	45	50	5	.40	250	99.2	96.8	20.00	35.51	43.03	7.52
6	15	80	5	−.80	250	99.2	99.6	10.40	50.74	62.62	11.88
20%											
7	80	20	0	2.40	250	98.4	99.2	29.20	31.78	33.17	1.39
8	50	50	0	.00	250	97.6	96.8	66.40	56.02	53.35	−2.67
9	20	80	0	−2.40	250	96.8	99.6	44.80	95.99	96.70	.71
10	75	20	5	3.20	250	97.2	97.6	13.20	24.00	27.87	3.87
11	45	50	5	.80	250	99.6	95.6	34.80	41.28	43.52	2.24
12	15	80	5	−1.60	250	95.2	98.0	18.80	66.20	71.15	4.95
40%											
13	80	20	0	4.80	250	95.2	96.8	63.20	31.67	30.80	−.87
14	50	50	0	.00	250	94.0	98.8	94.80	64.04	58.15	−5.89
15	20	80	0	−4.80	250	96.8	98.8	93.20	135.36	128.33	−7.03
16	75	20	5	6.40	250	95.2	95.2	14.40	24.26	25.99	1.73
17	45	50	5	1.60	250	93.6	94.0	43.20	46.81	47.15	.34
18	15	80	5	−3.20	250	93.2	94.8	18.00	86.49	88.47	1.98
Average values:					249.9	97.0	97.7	35.20	52.92	55.85	2.93

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[1] All numbers shown, except for the Good Trials, are percentages.

[2] The understatement and (non-100 percent) overstatement error taintings in Model 2 are represented by a chi-square distribution with two degrees of freedom and a mean value of .2.

the same format and statistical measures as previously presented in Tables 6(a) and 6(b) for accounts receivable populations. As shown in Tables 7(a) and 7(b), for a 95 percent nominal confidence level the total error rate of the inventory populations studied varies from ten percent to 60 percent,[8] the proportion of non-100 percent overstatement errors ranges from 15 percent to 80 percent, the proportion of understatement errors ranges from 20 percent to 80 percent, and the proportion of 100 percent overstatement errors ranges from zero percent to ten percent. While many of the error rate cases used by Dworin and Grimlund were examined, a number of additional error rate cases were also included. These were primarily cases where ten percent of the errors represent 100 percent overstatement errors for model 1, and cases with an equal mix of under- and overstatement errors for both models. We included these cases in order to test more fully the reliability of the QB method in those situations where the examples noted in Section 2 suggested that the QB method provided tighter bounds than the MM method.

From the coverage statistics shown in Tables 7(a) and 7(b), it may be seen that the 95 percent nominal confidence level of the QB and MM methods is generally reliable. However, the coverage statistic of each method fell below this nominal level in six out of the 42 studies for each method. The average coverage for the six QB and the six MM studies is 93.5 percent and 93.9 percent, respectively. Further, all 12 of these below nominal coverage studies were 40 percent error rate cases. In one of these studies it is possible to reject (at a five percent significance level) the assertion that the QB confidence bound is reliable (as discussed in the previous section). In this particular study (case 17 in Table 7(a)), the 90.8 percent coverage is less than the critical 92.3 percent level noted in footnote 3.

As expected from our preliminary comparison (in Section 2) of the QB and MM methods, the QB method tends to provide a lower bound than the MM method when applied to accounting populations for which the over- and understatement error taintings are nearly matched. Case 14 in Tables 7(a) and 7(b) with a 40 percent error rate shows this effect. The "QB low" statistic of this case is 86.8 percent for model 1 and 94.8 percent for model 2. However, as may also be seen from these tables, the frequency with which the QB method produces a tighter bound than the MM method decreases rapidly as the characteristics of the population begin to differ from those of this case. In particular, this is noticeable as the total error rate decreases, or as the fraction of errors represented by 100 percent overstatement errors increases from zero percent to five percent (in this case, the coverage of the QB bound also declined rather sharply for model 1). As a result, it was possible to conclude in 36 out of 42 cases that the MM bound is, on average tighter than the QB bound (at a five percent significance level).

From the "QB Advan." and "MM Advan." columns of Tables 7(a) and 7(b), it is readily apparent that both methods can produce substantially tighter confidence bounds for inventory than those given by the Stringer method. For example, the average advantage of the QB method (relative to the Stringer bound) ranges from 37 percent for model 1 to 52.9 percent for model 2; and the average advantage of the MM method ranges from 44.0 percent for model 1 to 55.9 percent for model 2. It should, however, be noted that these advantages would be slightly smaller if the Meikle [1972] understatement adjustments to the Stringer procedure (also discussed by Goodfellow, et al. [1974]) were used.[9] Unlike the Stringer procedure (with or without the Meikle adjustments), both the QB and MM methods allow the understatement errors to directly offset the overstatement errors. This is an important advantage of the QB and MM methods when applied to inventory populations, and is one of the main factors responsible for the greater tightness of these bounds (as may be noted from Table 7 of McCray's paper [1984, p. 47]).

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[8] At these higher error rates the QB computational difficulties that we encountered in 0.87 percent of the accounts receivable trials occurred much less frequently (i.e., in five out of 10,500 inventory trials).

As in the case of accounts receivable, the "extra advantage" of the MM method over the QB method is greatest for low error rates and small error taintings, and declines as the error rates and the size of the error taintings increase. Indeed, for error rates greater than 20 percent in model 1 or ten percent in model 2, there is no meaningful difference between the performance of the two methods.

As with accounts receivable, comparable tables for our inventory studies are also available from the authors for the 99 percent, 90 percent, and 80 percent nominal confidence levels. In the inventory studies (with higher error rates) the performance of the two methods depends more on the nominal confidence level than was the case with accounts receivable. For example, the average "extra advantage" of the MM method for model 1 goes from 13.10 percent to −1.31 percent as the nominal confidence level goes from 99 percent to 80 percent. Similarly, for model 2 the average extra advantage goes from 9.45 percent to −4.71 percent.

Despite the shift in the relative advantage at the 80 percent confidence level, both methods still provide significantly tighter bounds than the Stringer method. For example, with model 2 the average advantages of the QB and MM methods are 71.11 percent and 66.70 percent, respectively, at the 80 percent confidence level. In this case, the slightly greater advantage of the QB method is achieved through a slight reduction in the QB coverage. In particular, the actual QB coverage was less than the nominal 80 percent level in eight out of the 12 inventory studies that we conducted with 20 percent to 40 percent error rates. However, in none of these eight cases did the coverage fall below the 75.6 percent critical value developed in the appendix. Thus, the reliability of the nominal 80 percent confidence level of the QB bound could not be rejected (at a five percent significance level).

CONCLUSIONS

The results obtained from our simulation studies show that the nominal confidence levels for both the QB and MM methods are generally reliable over the range of accounting populations spanned by our 96 test populations. Further, both methods provide tighter bounds than the Stringer procedure when applied to accounts receivable and inventory accounts. The performance of neither method uniformly dominates the other. These are our major conclusions.

The MM method appears to be much easier to set up and use, and requires far less computational effort than the QB method. While the MM bound can be calculated easily on any microcomputer (regardless of sample results), the computational effort required for the QB bound increases as the number of error taintings increases. This may be of particular concern in inventory applications where error rates and sample sizes often lead to a relatively large number of observed error taintings (e.g., 30 or more in a sample size of 100). In addition, we found that occasionally it was necessary to adjust the various control parameters of the QB method in repeated computer runs to get the QB method to work properly.[10]

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[9] Meikle [1972] showed how the observed understatement taintings can be used to calculate a lower precision limit which is then subtracted from the overstatement upper precision limit. Such an adjustment has not been used in this work in order to be consistent with the approach taken in Dworin and Grimlund. Moreover, we have used the unadjusted Stringer bound primarily as a way of comparing the QB and MT bounds when small values are involved. Consequently, Meikle's understatement adjustment, which does not significantly reduce the magnitude of the Stringer bounds, is not critical for this comparison.

For low error rate populations, the MM method generally provided significantly tighter bounds than the QB method. The MM bound was on average, over all error rates, tighter than the QB bound in all but four of our 54 accounts receivable studies, and in all but seven of our 42 inventory studies. However, the QB bound tended to provide tighter bounds at the higher error rates, especially when the understatement errors were comparable to, or dominated, the overstatement errors.

For McCray's examples, which were examined in Section 2, the relative performance of the two bounds was insensitive to the choice of sample size. We are thus inclined to believe that additional simulation studies at a sample size of 200 (rather than the sample size of 100 used in our simulation studies) would lead to similar conclusions regarding the relative performance of the two methods. Of course, as noted in Section 2, these examples may not be fully representative of results found in practice. A sample size of 200 would generally double the number of error taintings observed at each of our error rates, and would seriously increase the computational requirements for calculating a large number of QB bounds.

Finally, we remind the reader that (as indicated in footnote 1) we have only considered the use of the QB method with McCray's uniform prior. We have not considered alternative applications of the QB procedure where an informative prior judgment is incorporated into the quasi-Bayesian analysis of the QB method. It may be that these Bayesian attributes of the QB method are particularly useful in incorporating additional information about the accounting population being audited. We leave it to future research to explore this potential use of the QB method.

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[10] We went through such an exercise on a study by study basis, in order to reduce the QB failures in our nine three-percent accounts receivable studies from initial failure rates of ten to 15 percent to a final failure rate of 1.5 percent over all nine accounts. As previously noted, additional trial by trial adjustments, in order to further decrease the failure rate, were not attempted.

APPENDIX

THE STATISTICAL ACCURACY OF FREQUENCY MEASURES IN SIMULATION STUDIES

In this appendix we show how the three-parameter gamma distribution described by Dworin and Grimlund may be used to obtain a more accurate calculation of the standard error associated with frequency measures in a simulation study.

$$\text{Let } x_i = \begin{cases} 0 \text{ if condition A is false} \\ 1 \text{ if condition A is true} \end{cases} \tag{A1}$$

In a simulation study using N trials, we observe the frequency of condition A being true:

$$f = \frac{1}{N} \sum_{i=1}^{N} x_i. \tag{A2}$$

Standard classical statistics, based on a normal distribution for the sampling distribution of f, yields a standard deviation for f of $\sqrt{f(1-f)/(N-1)}$. Cochran [1963, pp. 57] suggests a number of finite sample corrections to this basic expression, but also notes that these approximations may not be adequate for an N as low as 250 for certain values of f. It is not necessary, however, to assume a normal distribution for the sampling distribution of f. A three-parameter gamma distribution may be assumed instead. As indicated in Dworin and Grimlund [1984, pp. 238], the parameters of this distribution, and the desired percentile points, may be obtained from the first three noncentral moments of the sample values of x:

$$\begin{aligned} &SN_1=f;\\ &SN_2=\frac{1}{N}\sum_{i=1}^{N}x_i^2=\frac{1}{N}\sum_{i=1}^{N}x_i=f;\\ &SN_3=\frac{1}{N}\sum_{i=1}^{N}x_i^3=\frac{1}{N}\sum_{i=1}^{N}x_i=f. \end{aligned} \tag{A3}$$

Note that the first three noncentral moments all equal f. Consequently, the central moments are:

$$\begin{aligned} &SC_1=f;\\ &SC_2=f(1-f);\\ &SC_3=f(1-f)(1-2f) \end{aligned} \tag{A4}$$

Using the Elderton-Johnson identities (discussed in the Appendix of Dworin and Grimlund) we obtain the following central moments of the sampling distribution for the mean frequency f:

$$\begin{aligned} &UC_1=f;\\ &UC_2=f(1-f)/N;\\ &UC_3=f(1-f)(1-2f)/N^2 \end{aligned} \tag{A5}$$

Thus the parameters A, B, and G of the gamma distribution for the mean frequency f are given by:

$$\begin{aligned} &A=4Nf(1-f)/(1-2f)^2;\\ &B=.5(1-2f)/N;\\ &G=-f/(1-2f). \end{aligned} \tag{A6}$$

It follows from the approximation used by Dworin and Grimlund that the α-level confidence interval for an observed mean frequency f is between the limits:

$$C_+=[f/(1-2f)](-1+2(1-f[1+Z_\alpha/\sqrt{9A}-1/9A]^3) \tag{A7}$$

and

$$C_-=[(f/(1-2f)](-1+2(1-f)[1-Z_\alpha/\sqrt{9A}-1/9A]^3) \tag{A8}$$

where Z_α is the 1-α percentile of the normal distribution.

In this paper we consider two different frequency measures: the "coverage" statistic, which measures the frequency with which a calculated confidence bound equals or exceeds the true mean error, and the "QB low" statistic which measures the frequency with which the QB bound is less than the MM bound. In both cases, we are seeking the critical value of the observed mean frequency f such that the null hypothesis $f>f_0$ may be rejected. In the first case, where the frequencies of interest are greater than 50 percent, it is more convenient to work with $f^*=1-f$.

The critical value, f^*, is obtained by setting $c_-=1-f_0$ and solving equation (A8) for f^*. For a five percent (one-sided) significance level, $z_{.05}=1.645$. For the first case, where the null hypothesis is that the coverage statistic is equal to or greater than 95 percent (i.e., $f_0=.95$), the critical value f^* is found to be 7.67 percent (or $f=92.33$ percent) when $N=250$. Likewise, at an 80 percent confidence level ($f_0=.80$), the critical value f^* is found to be 24.4 percent (or $f=75.6$ percent) when $N=250$. In order to obtain the critical frequency required to reject the converse hypothesis, as noted in footnote 4, we let $c_+=1-f_0$, with $f_0=.95$. Using equation (A7), it is then found that $f^*=3.1$ percent (or $f=96.9$ percent). For the second case, where the null hypothesis is that the QB bound is less than the MM bound in 50 percent or more of the trials ($f_0=.50$), we may work directly with f. Setting $c_+=f_0$, we find from equation (A7) that $f=44.81$ percent when $N=250$.

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Relative Forecast Accuracy and the Timing of Earnings Forecast Announcements

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ABSTRACT: Previous studies concerning the relative accuracy of management and financial analyst earnings forecasts have produced conflicting conclusions. Resolving this conflicting evidence is important because of the role relative accuracy potentially plays in such issues as the imposition of mandatory management forecast disclosures, the information content of management versus analyst forecast releases, and the motive of management in providing earnings forecasts to the market. Using weekly consensus (mean) financial analyst earnings forecasts, we document a close association between relative forecast accuracy and the timing of the release of the forecasts. We find that management forecasts issued subsequently to, coincidentally with, and up to four weeks prior to analyst forecasts are significantly more accurate than the analysts' estimates. The consensus analyst forecasts are more accurate beginning the ninth week after the release of the management forecast. Thus, by more closely controlling for the timing of the analysts' forecasts, we are able to provide a more precise picture of the dynamic nature of relative forecast accuracy.

This paper reports the results of an empirical investigation into the relationship between the relative accuracy of financial analyst and management forecasts of earnings per share (EPS) and the timing of the release of the forecasts. Underlying this research is abundant theoretical and empirical literature which supports the notion that investors are interested in obtaining information about a company's future earnings. For example, Givoly and Lakonishok [1984, p. 117] assert: "Earnings per-share emerge from various studies as the single most important accounting variable in the eyes of investors."[1] Aiding the dissemination of such information, the financial press prominently displays earnings forecasts made by management and financial analysts. In addition to the popular press, at least four publications regularly report EPS predictions. The four publications

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[1] See Abdel-khalik and Thompson [1977] and Givoly and Lakonishok [1984] for reviews of empirical literature dealing with earnings forecasts. Gonedes [1974] and Chang and Most [1980] provide empirical evidence that investors desire to acquire information concerning future earnings per share data.

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are Standard and Poors' *Earnings Forecaster*, Value Line's *Investment Service*, the Lynch, Jones and Ryan *Institutional Brokers Estimation Service* (IBES), and Zacks Investment Company's *Icarus Service*.

The relative accuracy of management and analyst earnings forecasts has been investigated by several researchers. Despite this effort, no consistent conclusions emerge. Basi, Carey and Twark [1976] construct their sample so that analyst forecasts are issued prior to the release of the management forecast. Although they find management forecasts to be more accurate on average, the difference is not statistically significant. Ruland [1978] and Jaggi [1980] develop samples of analyst forecasts issued both before and after the release of management forecasts. While they agree that there is no statistically significant difference in the relative accuracy of the analyst forecasts issued *subsequent* to the management forecasts, their findings differ with regard to the relative accuracy of analyst forecasts issued prior to management's. Ruland is unable to reject the null hypothesis of equal accuracy. Jaggi, on the other hand, concludes that the managers are significantly more accurate. Imhoff and Pare [1982] examine the relative accuracy of analyst forecasts *nearest* to the management forecasts. They find no statistically significant difference in accuracy. In a study of companies in The Netherlands, Schreuder and Klaassen [1984] report no statistical differences between the accuracy of non-publicly available management and analyst profit forecasts. They did not report how many of the analyst forecasts were issued before or after the management forecasts.

The exact timing of the analyst forecast *vis-a-vis* the management forecast is not discussed extensively in the work referenced above. Generally speaking, the authors said that they tried to find analyst forecasts dated as near as possible to the date that the management forecast was publicly released. However, controlling for the length of time between analyst and management forecasts may be crucial. The contradictory comparative accuracy results of previous studies could be a function of how far away in time the analyst forecasts were from the management forecasts.

Waymire [1985] uses the two issues of the Standard and Poor's *Earnings Forecaster Cumulative Master List* prior to and subsequent to the release of a management forecast (i.e., four issues) to collect analyst forecasts. He finds that the management forecasts are significantly more accurate than the analyst forecasts when the analyst estimates are reported prior to the release of the relevant management forecast. When the analyst forecasts are reported subsequent to the management estimate, the findings are sensitive to the number of analysts following the firm. If the analyst following was "high" (three or more analysts), Waymire found no significant difference in accuracy. If, however, the analyst following was "low," the *management* forecast was (statistically) more accurate than the subsequently reported analyst estimate.

Thus, the existing evidence regarding the relative accuracy of analyst and management forecasts is ambiguous. Attempting to resolve this conflicting evidence would be important in its own right. In addition, new evidence regarding relative forecast accuracy may permit insights into other, more fundamental, issues.

Underlying the early studies, i.e., Basi, Carey and Twark [1976] (hereafter, BCT) and Ruland [1978], was the serious consideration being given to the imposition of mandatory management earnings forecasts at the time of their writing (mid-1970s). While Gonedes, Dopuch and Penman [1976] demonstrate the complexity of the mandatory disclosure question, relative accuracy does appear to have a role to play. For example, one issue raised by Gonedes, Dopuch and Penman (hereafter, GDP) is whether management forecasts are a perfect substitute for financial analyst forecasts. They offer the following argument against this proposition (p. 105):

> This may be the case when, for example, the "quality" of management's forecast is not viewed as being the same as that of the other forecasts.

To the extent that quality and accuracy are correlated, GDP's analysis seems to support continued investigation into the relative accuracy issue.

Another important issue is the effect of earnings forecasts on investor expectations (the latter variable is proxied by abnormal stock price changes following the release of the forecast). Numerous studies, e.g., Patell [1976], Jaggi [1978], Nichols and Tsay [1979], Penman [1980], and Waymire [1984], indicate that management earnings forecasts appear to have information content. Likewise, research by Fried and Givoly [1982] and Givoly and Lakonishok [1979] indicates a similar association between the revision of financial analyst forecasts and stock price movements. A more thorough understanding of the relative accuracy of management and financial analyst forecasts may provide future researchers with insights into differential stock price movements around the dates of earnings forecast releases.

Finally, studies of this type may provide insight into the question of why managers issue earnings forecasts. A recent article by Ajinkya and Gift [1984, p. 426] proposes an "expectations adjustment" hypothesis which posits that management forecasts are intended to adjust prevailing market expectations towards management's beliefs about future earnings. They find stock price reactions to the release of management forecasts that are consistent with this conjecture. Additional evidence regarding relative forecast accuracy may permit a more informed opinion to be formed concerning this hypothesis.

PURPOSE OF THIS STUDY

This study furnishes empirical evidence concerning the relative accuracy of analyst and management earnings forecasts as a function of the timing of the reported analyst forecasts. Of particular interest is the time period *after* the release of the management earnings estimate. Waymire [1985] examines the two- to four-week periods immediately before and immediately after the managers' announcements. With this exception, none of the other relative accuracy studies provide precise information regarding the timing of the analyst and management forecasts. Our study controls more closely for this timing issue since the analyst consensus forecast data source is updated weekly.

We also feel that it is of interest to examine a longer post-management-announcement observation period than Waymire examines. Typically, it is posited that management is in a superior position to forecast earnings relative to analysts at any given point in time because the managers are in possession of inside information (e.g., future plans and unaudited, non-public financial statements) that provide them an advantage. Announcing the earnings forecast, however, may only imperfectly reveal this inside information to analysts. Furthermore, an analyst may believe he/she has a comparative advantage at gathering and/or interpreting economic and industry data. In either case, analysts may not immediately revise their beliefs to the management forecast amount. They may wait for confirming information (e.g., the explicit or implicit revelation of plans and the release of financial statements) before making major revisions in their prior beliefs. We examine the relative accuracy of reported analyst forecasts for up to 12 weeks subsequent to the management forecast.

Following this introduction is a discussion of the sample selection and data collection procedures. We then describe our analysis techniques and results. The paper closes with a summary of our findings and a discussion of some limitations of our work.

DATA COLLECTION PROCEDURES

To assess the comparative accuracy of analyst and management earnings forecasts, a sample of forecast data was constructed. Since management forecasts are issued relatively infrequently, the first data set consisted of management earnings forecasts. The second data set included analyst forecasts of the firms for which management forecasts were found.

We used the Dow Jones News Retrieval Service (DJNRS) as our source of management earnings forecasts. The DJNRS contains a constantly updated data base of articles published by Dow Jones & Company in *The Wall Street Journal* and *Barrons*, as well as unpublished announcements appearing on the Broad Tape. The key words we used to query the data base were words that would indicate that the article was reporting a management forecast of EPS.[2] In response to inquiries using these key words, articles published between June 1979 (the inception of the DJNRS data base) and December 1982 (the end of our analyst forecast data) were retrieved. Each article was examined to determine if it contained a useful annual EPS forecast. To be included in the sample, the following conditions were imposed:[3]

1. The forecast was attributed to a corporate official;
2. The forecast was a specific point estimate of annual EPS (if earnings were given, EPS was calculated using the previous year's shares outstanding) or, if range estimates were presented, the midpoint was used; and
3. The forecast had to be issued at least one month before year-end.

The third requirement is necessary to preserve some time for analysis after the management forecast date. After imposing these constraints, a sample of 247 usable management forecasts of annual EPS was obtained for this study.[4]

After this management forecast sample

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[2] Although the key words selected provide an extensive coverage of the potential wording of management forecast releases, the coverage is not exhaustive. Thus, our study produces only a sample of the management forecasts that were released during the period. We have no *a priori* reason to believe that this sample is biased in any manner.

[3] These restrictions are similar to those used in the Basi, Carey and Twark [1976], Ruland [1978], Jaggi [1978, 1980] and Imhoff and Pare [1982] studies. However, in our study, management forecasts could have been made one to 12 months before year-end. The studies referenced above restricted management forecasts to eight to 14 months before year-end. (Waymire [1984, 1985] used the same forecast horizon limits as we employed.) Also, we did not restrict our sample to only one forecast per fiscal year. The conclusions are identical, excluding the "duplicate" forecasts from the sample.

[4] The following table briefly summarizes our experience in collecting our sample of management forecasts.

	Number	*Proportion of Articles Retrieved*
Usable (either directly or converted)	247	(.27)
Less than one month prior to fiscal year-end (includes those issued after year-end but before the actual earnings announcement)	329	(.35)
Management quotes analyst forecast	51	(.05)
Management forecast open-ended (e.g., at least $3.00 a		

was assembled, weekly consensus analyst forecasts of EPS were collected from Zacks Investment Company's *Icarus Service*. Zacks accumulates up to 60 analyst forecasts for about 2,400 companies and resells them to interested subscribers. The service reports, among other things, a weekly consensus (mean) analyst annual EPS forecast.

Any study employing time-series data of consensus analyst forecasts must address two issues. The first is the question of whether "out-of-date" individual forecasts are included in the calculation of the reported consensus forecast. Since our data source supplies no information about the individual analysts comprising the consensus, we cannot control for the age of the individual forecasts included in the consensus. Therefore, the consensus earnings estimates used in our study may (and probably do) contain individual forecasts that are "old." While these individual forecasts may be old, it is in the analyst's best interest to be sure they are not "excessively" out-of-date. To understand the difference, note that in each time period an analyst may: 1) make a new forecast; 2) leave the present forecast unchanged; or 3) withdraw the forecast and not report a forecast for the firm in question. The last option is valuable to an analyst in the situation in which he or she is uncomfortable with the current forecast but lacks the time to reanalyze the firm. This does not imply, however, that each individual forecast is the same as would exist if the analyst were to completely reanalyze the firm. Instead, it is likely that an analyst allows new information to accumulate until he or she believes a new analysis is warranted. This tendency to be out-of-date is balanced against the concept that an analyst's compensation generally is directly related to the accuracy of the forecast. Thus, analysts have the opportunity and the incentive (assuming compensation based on forecast accuracy) to withdraw forecasts that are "excessively" out-of-date.[5]

The second area of concern is whether significant reporting lags exist between the time financial analysts make a forecast and when that forecast appears on the Zacks data base. Undoubtedly such lags exist. Reports must be printed, mailed from the brokerage house to Zacks, and placed into the data base by the Zacks staff. If the data base date were the date the forecast was received or posted by Zacks, a considerable amount of time might elapse between the forecast production and its incorporation into the data base. Fortunately, the date Zacks associates with a particular analyst forecast is the *date the forecast was reported to the brokerage firm's sales force*, not the date it is received by Zacks. Since most analysts have daily "morning meetings" with the sales force, this date should approximate fairly closely the date the forecast was produced. Preferred clients may receive a couple days advance notice, but this backdating procedure should preclude any significant timing problems. This date certainly represents the beginning of the public dissemination of the data *by the brokerage firm*.

An example may be useful in understanding Zacks' procedure. Suppose a revised analyst forecast is received by Zacks in week t bearing a date of two weeks earlier (week t-2). That forecast is entered into the data base with the two-week-old date. Thus, the individual analyst fore-

share, record profit, greater than last year)	301	(.33)
Total management forecasts of annual EPS (directly or convertible to EPS)	928	(1.00)

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[5] For a similar discussion of the competitive nature of the forecasting business, see footnote 8 of Imhoff and Pare [1982].

casts are pre-dated when entered into the Zacks data base. That is, the date attached to an individual analyst forecast may precede the entry date by several days. If in week *t* Zacks produces a historical record of consensus forecasts, not only will the consensus forecast of week *t* be affected, but the prior two weeks' (*t*-1 and *t*-2) consensus forecasts will be affected as well. This implies that we cannot devise real-time trading rules based on the shifts in the analyst forecasts, since Zacks subscribers are subject to these reporting lags, i.e., Zacks subscibers in this example note the revision in week *t*. However, we should be able to extract a fairly accurate historical picture of the timing of analyst revisions in the Zacks' data base.

Weekly consensus analyst forecasts were collected, both before and after the date of the management forecasts, up to a maximum of 12 weeks in either direction. The week of a management forecast is defined as time zero. Weeks *after* the management forecast week are numbered +1 to +12. Weeks *before* the management forecasts are numbered −1 to −12. One exception to the collection procedure was when management earnings forecasts occurred less than 12 weeks prior to the beginning or end of the fiscal year. In this case, analysts' forecasts were included only for the length of time available in the current fiscal year. One hundred and twenty-three firms with management forecasts (principally those traded over the counter) were found that were not in the Zacks data base or had incomplete analyst forecast data. Therefore, the sample for this study consists of 124 management forecasts.[6] (See the Appendix for a list of the firms and management forecast dates.)

Besides the difference in sample period from the other relative accuracy forecast studies, our sample also differs with respect to the regulatory environment surrounding the release of management forecasts. One issue involved in the discussion of the merits of a mandatory disclosure rule is the liability of management for inaccurate projections. During the period of time over which most of the previous management forecast samples were collected (1970–74), the liability issue remained uncertain. In June 1979, the Securities and Exchange Commission moved to reduce this uncertainty and encourage voluntary management forecasts by adopting a safe harbor rule, which became effective on July 30, 1979, for management projections.[7] Thus, while our sample still contains only voluntary earnings forecasts, these forecasts were made in less uncertain legal liability environments than the forecasts included in the previous studies.

Table 1 illustrates that the firms in our sample are mainly calendar year-end, New York Stock Exchange-listed firms releasing one forecast during our sample period. A majority of the forecasts were released late in the fiscal year (51 percent were released in the third and fourth fiscal quarters). The analyst following is fairly evenly distributed between one and 12 analysts and a large number of industries are represented (34 two-digit SIC codes in seven SIC Divisions). Finally, we note that a significant number (42 of 124) of our sample observations are not reported in the Wall Street Journal Index (WSJI), which was the source of management forecasts in several of the prior studies.

A priori, one might expect that the

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[6] This size sample compares favorably to the sample sizes in Basi, Carey and Twark [1976], Ruland [1978], and Imhoff and Pare [1982]. It is similar in size to that in Jaggi [1980] and considerably smaller than Waymire's [1984a]. The reason for such a discrepancy in sample size for time periods of almost equal length is not obvious, although search technique and sample period are two possibilities.

[7] See SEC Docket, Volume 17, Number 15, release number 33-6084 for a complete description of the ruling.

TABLE 1
CHARACTERISTICS OF MANAGEMENT FORECAST SAMPLE

Frequency of Forecast		*Fiscal Year-End*		*Timing of Forecast*						*Exchg. Listing*		*Analyst Following*	
				Fiscal Mo.		*Fiscal Qtr.*		*Calendar Year*					
No. of F'cast. by Firm	*No. of Firms*	*Month*	*No. of Firms*	*Month*	*No.*	*Qtr.*	*No.*	*Year*	*No.*	*Exchg.*	*No. Firms*	*No. of Analysts*	*No. of Obs.*
1	73	1	5	1	3	1	19	1979	22	NYSE	85	1–3	24
2	14	2	3	2	7	2	42	1980	45	ASE	3	4–6	32
3	4	3	1	3	9	3	24	1981	31	OTC	5	7–9	26
4	1	4	3	4	17	4	39	1982	26			10–12	24
5	0	5	3	5	13						93	13–15	12
6	0	6	10	6	12		124		124			>15 (max 24)	6
7	1	7	1	7	8								
		8	3	8	8								124
	93	9	3	9	8								
		10	4	10	20								
		11	1	11	19								
		12	56										
					124								
			93										

Industry Affiliation

SIC Divisions	*No. of Firms*
B. Mining	4
D. Manufacturing	55
E. Transportation, Communication, Electric, Gas and Sanitation Service	12
F. Wholesale Trade	1
G. Retail Trade	10
H. Finance, Insurance and Real Estate	4
I. Services	7
	93

Reporting Services

Source	*No. Obs.*
DJNRS & WSJI	82
DJNRS only	42
	124

management forecast announcements not appearing in the WSJI would be on non-NYSE-listed, less widely followed firms. While this is somewhat true, the differences are not extreme. We find that the DJNRS-only sample has four of the eight total firms that are non-NYSE listed, when we would have only expected two or three by chance. Likewise, the DJNRS-only sample firms are followed by an average of 7.7 analysts as compared to 8.1 analysts for the overall sample.

DATA ANALYSES

The objective of this research is to investigate the dynamic nature of the relative accuracy of management and financial analyst EPS forecasts. To address this issue, the cross-sectional average management forecast error at time $t=0$ and the time series of cross-sectional average consensus financial analyst forecast errors for $t=-12$ through $t=+12$ (or through the end of the fiscal year for some firms) are computed. For the purposes of this study, the forecast error (FE) is defined as the absolute percent difference between the forecast and actual EPS.[8] That is,

$$FE_{j,t}=|(F_{j,t}-A_j)/A_j|,$$

where

$FE_{j,t}$ = the forecast error at time t for firm j,
$F_{j,t}$ = the forecast at time t for firm j, and
A_j = the relevant actual annual EPS figure for firm j (all were positive for our sample).

We calculated forecast errors for both the management (MFE_j) and financial analyst ($FAFE_{j,t}$) forecasts.[9]

In Table 2 we provide some descriptive statistics of the distribution of forecast errors. Row one represents the distribution of the management errors, while the next 25 rows describe the analyst error distribution on a weekly basis in time units relative to the release of the management forecasts. As one would expect, the analyst error distribution initially lies to the right (towards larger errors) of the management distribution. Then, as time passes, the analyst error distribution begins to shift to the left (towards smaller errors). The median analyst forecast error is less than the median management error from week five through week 12 (the end of the time we track the errors).

Also presented in Table 2 are the results of a parametric t-test for equality in the sample means between the management errors and the analyst errors at each point in time. From an examination of the seventh column, one can observe that the mean of the analyst errors is statistically greater than the management mean only in weeks -12 through -1. The mean analyst forecast error is greater than management's through week seven. While the mean analyst error is less than management's in weeks nine through 12, the difference is not statistically significant. Finally, the last column of Table 2 indicates that the hypothesis that the forecast error distributions are normal can be rejected at the 99 percent confidence level at each time period.[10] This casts doubt on the validity of the parametric test.

To test further for a significant difference in management and analyst forecasting ability, we conducted a series of Wilcoxon signed-ranks tests.[11] At each point

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[8] To be sure our test results were not being driven by a few outliers, we replicated our statistical tests with all forecast errors truncated at 1.0. We also examined the sensitivity of our tests to an alternative error metric: $FE_{j,t}=[(F_{j,t}-A_j)/A_j]^2$. All tests reached similar conclusions.

[9] For the management forecast error (MFE) the time subscript is always zero ($t=0$). Thus, we compare the relative accuracy of a given management forecast to a time series of analyst forecasts.

[10] See Fama [1976, pp. 33–40] for a discussion of the Studentized Range.

[11] See DeGroot [1975, Chapter 9] for a detailed

TABLE 2

DESCRIPTIVE STATISTICS OF THE PERCENT FORECAST ERRORS—ALL OBSERVATIONS

Variable	*Minimum*	*Tenth Percentile*	*Median*	*Ninetieth Percentile*	*Maximum*	*Mean*	*Studentized Range*
MFE	.000	.008	.065	.368	2.415	.150	9.444**
FAFE (−12)	.000	.023	.109	.538	3.057	.224*	8.990**
FAFE (−11)	.000	.022	.113	.537	3.000	.222*	8.933**
FAFE (−10)	.000	.022	.108	.512	3.000	.221*	8.946**
FAFE (−9)	.000	.019	.111	.518	3.189	.221*	9.154**
FAFE (−8)	.000	.018	.105	.518	3.208	.214*	9.199**
FAFE (−7)	.000	.018	.109	.548	3.189	.221*	9.101**
FAFE (−6)	.000	.019	.111	.535	3.132	.222*	9.120**
FAFE (−5)	.000	.019	.108	.515	3.132	.216*	9.188**
FAFE (−4)	.000	.017	.106	.508	3.019	.210*	9.116**
FAFE (−3)	.000	.014	.101	.508	3.019	.208*	9.077**
FAFE (−2)	.000	.018	.102	.517	2.925	.211*	8.835**
FAFE (−1)	.000	.016	.104	.495	2.925	.209*	8.916**
FAFE (0)	.000	.014	.097	.469	2.887	.195	9.146**
FAFE (+1)	.000	.013	.093	.472	2.811	.186	9.137**
FAFE (+2)	.000	.012	.077	.469	2.679	.177	8.985**
FAFE (+3)	.000	.010	.073	.455	2.679	.174	8.993**
FAFE (+4)	.000	.009	.071	.438	2.679	.171	8.990**
FAFE (+5)	.000	.008	.063	.444	2.566	.166	8.825**
FAFE (+6)	.000	.010	.062	.437	2.566	.160	8.825**
FAFE (+7)	.000	.007	.055	.426	2.566	.153	8.807**
FAFE (+8)	.000	.007	.057	.435	2.566	.150	8.800**
FAFE (+9)	.000	.006	.051	.374	2.547	.141	8.799**
FAFE (+10)	.000	.005	.042	.375	2.396	.133	8.598**
FAFE (+11)	.000	.003	.035	.375	2.226	.129	8.318**
FAFE (+12)	.000	.003	.026	.375	2.019	.124	7.936**

* Rejects the null hypothesis that the mean FAFE equals the mean MFE (at the 95 percent confidence level).
** Rejects the null hypothesis that the forecast errors are distributed normally (at the 99 percent confidence level).

in time ($t=-12$ through $t=+12$), pairs of forecast errors, MFE$_j$ and FAFE$_{j,t}$, were matched for every firm in the sample having an analyst forecast at that time and were compared for accuracy. The null hypothesis (H$_0$) to be tested at each point in time is that there is no difference in the EPS forecast errors of the firm manager and the consensus of the financial analysts. Table 3 summarizes our findings.

From time $t=-12$ through $t=+4$ the managers' forecast errors are significantly (at the five percent level or below) less than the analysts' errors. Weeks five through eight represent a period in which neither management nor analyst forecasts are significantly more accurate. During that time period the z-scores move from insignificantly negative to insignificantly positive (i.e., from indicating that analysts' forecasts are less accurate than managers' time zero forecasts to indicating that the analysts' forecasts are more accurate). Beginning in week +9, the analysts' forecast errors are significantly less than the managers' errors.

Our results support the conjecture that relative accuracy does depend on the timing of analysts' forecasts relative to the management forecasts. Analyst forecasts reported prior to the release of the management forecasts (on average) have sig-

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discussion of the Wilcoxon signed-rank test procedures. This is the same test procedure used in the previous relative accuracy studies.

TABLE 3

STATISTICAL SIGNIFICANCE OF THE DIFFERENCE IN ACCURACY BETWEEN MANAGEMENT AND FINANCIAL ANALYST EPS FORECAST ERRORS

Time	*N*	*Z-score*
−12	120	−5.44**
−11	120	−5.54**
−10	120	−5.42**
−9	120	−5.36**
−8	120	−5.19**
−7	121	−5.23**
−6	122	−5.31**
−5	122	−5.29**
−4	124	−5.06**
−3	124	−5.02**
−2	124	−4.86**
−1	124	−4.82**
0	124	−4.58**
1	124	−3.93**
2	124	−3.10**
3	124	−2.56*
4	124	−2.20*
5	118	−1.05
6	115	−.19
7	109	1.14
8	107	1.72
9	100	3.09**
10	96	4.52**
11	89	5.66**
12	84	6.28**

* Significant at the 95 percent confidence level.
** Significant at the 99 percent confidence level.

nificantly *higher* forecast errors than the management forecasts, as do those analyst forecasts reported up to four weeks subsequent to the manager's announcement. The fact that we are able to document a significant relative accuracy advantage in favor of management even in the post-management-announcement period is consistent with Waymire's [1985] results. If analysts' forecasts are selected from the period of weeks +5 to +8, the results from our sample indicate no significant difference in accuracy. Finally, when examining analyst forecasts reported at least nine weeks subsequent to the management announcement, one finds the analysts significantly more accurate than management.

Before comparing our results to the findings of previous work, we must recall that our sample of management forecasts includes forecasts released late in the fiscal year. Previous studies, however, examined forecasts released relatively early in the year. (In fact, some forecasts included in previous studies occurred more than 12 months prior to the end of the reporting period.) To address this issue, we divided our sample into two groups. The first group included all management forecasts made in the first or second fiscal quarter. (We were unable to break the sample down further due to the small number of first quarter forecasts.) The second group consisted of management forecasts made in the latter half of the fis-

TABLE 4A

DESCRIPTIVE STATISTICS OF ABSOLUTE PERCENT FORECAST ERRORS
(MANAGEMENT FORECASTS IN FIRST HALF OF FISCAL YEAR)

Variable	*Minimum*	*Tenth Percentile*	*Median*	*Ninetieth Percentile*	*Maximum*	*Mean*	*Studentized Range*
MFE	.000	.010	.107	.405	2.415	.241	6.811**
FAFE (−12)	.001	.022	.130	.648	3.057	.289	6.625**
FAFE (−11)	.000	.021	.140	.637	3.000	.285	6.604**
FAFE (−10)	.000	.021	.140	.648	3.000	.287	6.625**
FAFE (−9)	.000	.021	.140	.647	3.189	.288	6.724**
FAFE (−8)	.000	.021	.120	.648	3.208	.278	6.739**
FAFE (−7)	.000	.028	.120	.647	3.189	.287	6.731**
FAFE (−6)	.000	.033	.180	.647	3.132	.287	6.765**
FAFE (−5)	.000	.031	.180	.648	3.132	.289	6.762**
FAFE (−4)	.013	.037	.180	.635	3.019	.283	6.728**
FAFE (−3)	.013	.036	.180	.588	3.019	.285	6.696**
FAFE (−2)	.018	.038	.180	.598	2.925	.278	6.671**
FAFE (−1)	.018	.036	.170	.598	2.925	.275	6.696**
FAFE (0)	.009	.034	.167	.589	2.887	.267	6.750**
FAFE (+1)	.015	.028	.161	.585	2.811	.253	6.724**
FAFE (+2)	.007	.017	.140	.585	2.679	.247	6.658**
FAFE (+3)	.007	.021	.120	.575	2.679	.240	6.664**
FAFE (+4)	.007	.017	.120	.588	2.679	.239	6.644**
FAFE (+5)	.000	.021	.120	.576	2.566	.236	6.562**
FAFE (+6)	.000	.021	.120	.556	2.566	.234	6.534**
FAFE (+7)	.000	.021	.112	.556	2.566	.230	6.534**
FAFE (+8)	.000	.021	.112	.556	2.566	.228	6.527**
FAFE (+9)	.000	.021	.110	.576	2.547	.226	6.505**
FAFE (+10)	.000	.015	.107	.536	2.396	.218	6.250**
FAFE (+11)	.007	.015	.107	.536	2.226	.214	6.250**
FAFE (+12)	.007	.021	.107	.516	2.019	.209	6.057**

** Rejects the null hypothesis that the forecast errors are distributed normally (at the 99 percent confidence level).

cal year (still excluding the last fiscal month). Descriptive statistics of the error distributions and parametric tests of mean differences are displayed in Tables 4a and 4b.

Comparing equivalent rows from Tables 4a and 4b reveals that, generally speaking, the error distribution of forecasts made late in the year lie to the left (on the forecast error axis) of the distribution of those made early in the year, i.e., they tend to be smaller. Furthermore, there appears to be much less change in the distribution of analyst forecast errors from week −12 to week +12 for those forecast errors in the first two fiscal quarters. This seems to indicate that analysts tend to "stick with" their forecasts made early in the year but converge more rapidly to the actual earnings figure later in the fiscal year.

Parametric *t*-tests for the differences in the mean forecast errors of management and analysts were performed with each of the subsamples. For the management forecasts issued in the first six fiscal months (Table 4a), the mean errors are not statistically different for any of the 25 weeks examined at the 95 percent confidence level. Once again, however, the studentized range test results indicate that care must be exercised in interpreting these findings. For the management forecasts released late in the fiscal year, the results

TABLE 4(B)

DESCRIPTIVE STATISTICS OF MEAN ABSOLUTE PERCENT FORECAST ERRORS
(MANAGEMENT FORECAST IN LAST HALF OF FISCAL YEAR)

Variable	*Minimum*	*Tenth Percentile*	*Median*	*Ninetieth Percentile*	*Maximum*	*Mean*	*Studentized Range*
MFE	.002	.006	.021	.212	.466	.080	4.431
FAFE (−12)	.000	.022	.094	.505	.780	.189**	4.027
FAFE (−11)	.000	.023	.102	.508	.780	.189**	4.023
FAFE (−10)	.000	.023	.096	.498	.780	.186**	4.005
FAFE (−9)	.000	.019	.098	.502	.780	.185**	4.021
FAFE (−8)	.000	.017	.094	.493	.780	.176**	4.079
FAFE (−7)	.000	.015	.104	.493	.780	.181**	3.944
FAFE (−6)	.000	.013	.104	.491	.780	.180**	3.996
FAFE (−5)	.000	.013	.102	.473	.780	.170**	4.231
FAFE (−4)	.000	.011	.106	.463	.780	.167**	4.264
FAFE (−3)	.000	.010	.089	.463	.780	.164**	4.280
FAFE (−2)	.000	.012	.085	.473	.965	.172**	4.709
FAFE (−1)	.000	.011	.085	.463	.965	.172**	4.746
FAFE (0)	.000	.010	.076	.455	.780	.152**	4.376
FAFE (+1)	.000	.010	.070	.462	.780	.147**	4.413
FAFE (+2)	.000	.010	.063	.435	.780	.140**	4.429
FAFE (+3)	.000	.007	.054	.435	.780	.137**	4.433
FAFE (+4)	.000	.007	.052	.433	.780	.134**	4.477
FAFE (+5)	.000	.006	.043	.425	.780	.126*	4.438
FAFE (+6)	.000	.006	.039	.405	.780	.117*	4.549
FAFE (+7)	.000	.005	.032	.365	.780	.108	4.632
FAFE (+8)	.000	.005	.031	.365	.780	.104	4.651
FAFE (+9)	.000	.004	.020	.293	.537	.074	4.121
FAFE (+10)	.000	.004	.018	.285	.537	.066	4.220
FAFE (+11)	.000	.003	.016	.285	.537	.062	4.186
FAFE (+12)	.000	.003	.015	.285	.537	.057	4.157

* Significantly different from the average MFE at a 95 percent confidence level.
** Significantly different from the average MFE at a 99 percent confidence level.

are considerably different. Management is significantly more accurate (on average) than the analysts through week +6, while analysts never enjoy a significant advantage over the managers (although the mean analyst error is less than management's beginning in week nine).

Finally, in Table 5 we present the results of a Wilcoxon signed-ranks test of relative forecast accuracy for the two subsamples. Regardless of whether management forecasts are released early or late in the fiscal year, management forecasts released subsequent to analyst forecasts are significantly more accurate.

Conclusions regarding the relative accuracy of analyst forecasts released *after* management forecasts depend on the time during the year that the management forecast was released. If, as in previous studies, we confine our attention to management forecasts released early in the fiscal year, we find no significant differences in favor of analysts during the post-announcement period. This is consistent with the descriptive results reported in Table 4a. If only the management forecasts released during the third and fourth fiscal quarters are considered, we find that management forecasts are more accurate over the periods −12 through +2. No statistically different accuracy

TABLE 5

STATISTICAL SIGNIFICANCE OF THE DIFFERENCE IN ACCURACY BETWEEN MANAGEMENT AND FINANCIAL ANALYST EPS FORECAST ERRORS
(DIFFERENTIATED BY FISCAL QUARTER IN WHICH THE MANAGEMENT FORECAST WAS MADE)

	Mgt. Forecast Qtr. 1 & 2		*Mgt. Forecast Qtr. 3 & 4*	
Time	*N*	*Z-score*	*N*	*Z-score*
−12	53	−2.84**	67	−4.24**
−11	53	−2.97**	67	−4.22**
−10	53	−2.98**	67	−4.14**
−9	53	−2.99**	67	−3.99**
−8	53	−2.90**	67	−3.87**
−7	54	−3.07**	67	−3.76**
−6	55	−3.19**	67	−3.80**
−5	55	−3.25**	67	−3.72**
−4	57	−3.39**	67	−3.27**
−3	57	−3.51**	67	−3.13**
−2	57	−3.39**	67	−2.97**
−1	57	−3.09**	67	−3.22**
0	57	−3.09**	67	−2.87**
1	57	−2.36*	67	−2.74**
2	57	−1.72	67	−2.09*
3	57	−1.44	67	−1.53
4	57	−1.19	67	−1.28
5	57	−1.04	61	−.08
6	57	−.84	58	1.26
7	57	−.12	52	2.27*
8	57	.08	50	2.78**
9	57	.25	43	5.03**
10	57	.87	39	6.45**
11	57	1.00	32	8.56**
12	57	1.10	27	9.42**

* Significant, $\alpha = .05$
** Significant, $\alpha = .01$

appears to exist in weeks 3 through 6. In periods 7 through 12, the analyst forecasts are significantly more accurate than the previously released management forecasts.

Our results are consistent with the findings of Jaggi and Waymire concerning the relative accuracy of EPS forecasts when the analyst's forecast is released prior to the manager's forecast. This conclusion is independent of the time of the release within the fiscal year. Considering only the management forecasts released early in the fiscal year, our results are consistent with the findings of Jaggi and Ruland (if the analyst forecasts are reported at least two weeks after the release of the management forecast).

The difference in the relative accuracy between those forecasts released early and late in the fiscal year deserves additional attention. We pursued two lines of thought in trying to isolate possible explanations for this difference. The first issue examined was whether the firms in the early-in-the-year sample were different from those in the late-in-the-year group. Breaking the two samples into the SIC industry groupings reveals that the "early" sample has fewer observations in Manufacturing (Division D) and more in Transportation, Communications, Electric, Gas and Sanitation Services (Division E) and Services (Division I) than the "late" sample. However, a Mann-Whitney test cannot reject the null hypothesis that the two samples' industry groupings are identical.

Another possible reason that the early- and late-year sample results differ is that the two samples have systematically different information environments. Examining the average surprise ($|(FAF_{-1} - MF)/FAF_{-1}|$) of the management forecast compared to the week -1 consensus analyst forecast and the across-analyst diversity of opinion (a measure of analyst uncertainty) provides little evidence of any sample differences. The average surprise of the early sample is ten percent compared to 11 percent for the late sample. The average coefficient of variation (the standard deviation of the individual analysts' forecasts divided by the mean forecast) is .057 for the early firms and .055 for the late sample. Thus, the announcements early in the fiscal year contain, on average, slightly less surprise and are received by a somewhat more uncertain analyst audience. Neither factor seems sufficient to explain the difference in relative frequency noted in Table 5.

However, when we examined the frequency of good ($MF > FAF_{-1}$) and bad ($MF < FAF_{-1}$) news between the two samples, a systematic difference emerged. The early sample was 53 percent good news from management, while the late sample had only 44 percent favorable announcements.[12] Thus, part of the reason that analysts do not seem to respond as rapidly or as strongly to forecasts made early in the year may be a moral hazard problem. Analysts appear less convinced by good news management forecasts than by bad news forecasts.

One possible problem with the results reported in Tables 2-5 is that, relative to the release of quarterly earnings figures, the management and the analyst forecasts are of different forecast horizons. That is, if the management forecast is released in, say, late September and the third quarter's earnings figures are released in mid-October, it is unfair (in some sense) to examine the relative accuracy of the management forecast prepared without the knowledge of the third-quarter results to analyst forecasts prepared with that knowledge. In essence, the management estimate represents a two-quarters-ahead forecast while the analyst projection is only a one-quarter-ahead forecast. Although we believe the results as given in Tables 2-5 do provide insight into the relative forecast issue, we repeated the Wilcoxon test after truncating the collection of analyst data upon the release of an interim earnings figure (based on *Wall Street Journal Index* dates). That is, if an interim earnings announcement for firm *A* occurred in (say) week +6 relative to the management forecast, the last week that firm was included in the Wilcoxon relative accuracy test was week +5 (not the end of the fiscal year or week +12 as in the tests reported in Tables 2-5). Using the entire sample, the results (not reported here) indicate a significant accuracy advantage to management through week +2, with analysts capturing the edge in accuracy (significantly) in week +6. These results are similar to the overall results that ignore the release of interim earnings (reported in Table 3).

Waymire [1985] reports differing conclusions regarding the significance of relative forecast accuracy comparisons depending on whether the firm enjoyed a high or low financial analyst following at the time of the management forecast.

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[12] This is consistent with the findings of Pastena and Ronen [1979].

TABLE 6

STATISTICAL SIGNIFICANCE IN THE DIFFERENCE IN ACCURACY BETWEEN MANAGEMENT AND FINANCIAL ANALYSTS EPS FORECAST ERRORS (DIFFERENTIATED BY NUMBER OF ANALYSTS PROVIDING EPS FORECASTS)

	High Analysts (>7)		*Low Analysts* (<7)	
Time	*N*	*Z-score*	*N*	*Z-score*
−12	58	−3.06**	62	−4.14**
−11	58	−2.85**	62	−4.41**
−10	58	−2.69**	62	−4.41**
−9	58	−2.48*	62	−4.44**
−8	58	−2.31*	62	−4.35**
−7	59	−2.47*	62	−4.35**
−6	59	−2.46*	63	−4.37**
−5	59	−2.52*	63	−4.33**
−4	61	−2.74**	63	−3.99**
−3	61	−2.77**	63	−3.95**
−2	61	−2.56*	63	−3.85**
−1	61	−2.46*	63	−3.87**
0	61	−2.19*	63	−3.75**
1	61	−1.46	63	−3.52**
2	61	−1.05	63	−2.93**
3	61	−.79	63	−2.42*
4	61	−.67	62	−2.14*
5	61	−.33	57	−1.24
6	58	.67	57	−1.00
7	55	1.86	54	−.20
8	54	2.48*	53	.05
9	51	3.65**	49	.88
10	49	4.30**	47	1.69
11	44	5.87**	45	1.80
12	43	6.93**	41	1.95

* Significant, $\alpha = .05$
** Significant, $\alpha = .01$

Table 6 represents an effort to provide confirming evidence for this finding with our sample.

In our sample, firms for which seven (the median) or fewer analysts were reporting forecasts during the week of the management forecast release were classified as having a low analyst following. The other firms made up the high analyst subsample. The findings are consistent with Waymire's results. In each of the four weeks following the release of the management forecast, the difference in accuracy is insignificant for the high analyst firms but significantly in favor for the low analyst firms. Furthermore, the analysts' forecasts dominate the management estimates beginning in week eight for the high analyst firms but not until week +10 (and then only if we relax our confidence level to 90 percent) for the low analyst firms.

CONCLUDING REMARKS

This paper has provided a detailed examination of the relationship between relative forecast accuracy and the timing of the analyst and management earning forecasts. We examine the time period from 12 weeks prior to the release of the management forecast to 12 weeks after, using weekly observations of a consensus analyst forecasting source. Our overall findings indicate that management forecasts are statistically more accurate than analyst forecasts reported prior to, coincidentally with, and up to one month after the release of the management forecast. Analyst forecasts reported nine or more weeks subsequent to management's are significantly more accurate than the management forecasts. We also document evidence that these results are sensitive to the time of the fiscal year in which the management forecast is released and the size of analyst following at the time the manager makes the forecast.

A question not addressed by this paper (or the other papers in this area) is the role of information that becomes available only after the release of the management forecast. This information is available to help the analyst in forming his/her estimate but may not be available to the manager. In some sense this question is part of the larger issue of interest in the relative forecast accuracy literature: at what point in time (relative to the management forecast) are analyst forecasts more accurate than the associated management forecasts? Any situation in which the analyst and the management forecasts are not released at precisely the same time implicitly involves the possibility of differential information sets. This fact does not alter the importance of the question if timeliness is valuable to investors. However, it would also be interesting to examine the effect other information might have in influencing the accuracy of analysts' forecasts. To undertake such a study requires a model of the effect of various information sources on financial analyst beliefs. The development of this model would provide another area of interesting future research.

As with any empirical study, one must be careful when extrapolating the conclusions out of the sample. While our sample was fairly well diversified across the fiscal year-end of the firms, the number of analysts following the firms, and the industry membership, we had a disproportionate number of New York Stock Exchange-listed firms that released forecasts late in the fiscal year. It is possible that the reported results could be related to other characteristics of our sample firms as well.[13] Also, our sample differs from the previous relative accuracy literature with regard to the time period, sample selection technique, and regulatory environment. These differences must be considered in any comparison of results to the results of previous studies.

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[13] Papers by Hagerman and Ruland [1979] and Imhoff [1978] disscuss some of these issues in the context of security price response to forecast release.

Appendix

Firms Included in Sample (Management Forecast Date[s])

Albertson's Inc. (5/13/80)
Allen Group, Inc. (3/18/80, 6/26/81)
American Hospital Supply Co. (6/25/81)
ARKLA, Inc. (3/10/80, 5/22/80)
Arizona Public Service Co. (11/5/80, 2/11/81, 11/19/81)
Atlantic Richfield Co. (5/5/81)
Automatic Data Processing (8/24/81)
Avon Products (8/24/79)
Baldor Electric Co. (3/18/80, 5/2/80)
Bangor Punta Corp. (3/5/80, 5/22/80, 7/29/80)
Beatrice Foods, Inc. (11/21/80)
Best Products, Inc. (2/6/80)
Binney & Smith, Inc. (11/30/81)
Browning-Ferris Inds. (1/29/81)
CBI Industries (10/7/82)
Chyron Corp. (12/11/81)
Cincinnati Milicrom, Inc. (10/21/81, 5/13/82)
Circle K Corp. (11/20/79)
City Investing Co. (9/16/82)
Coleman Corp. (10/25/79, 7/16/82)
Community Psychiatric Centers (4/12/79, 9/26/79, 5/22/80, 7/13/81)
Consolidated Foods Corp. (10/30/80)
CPC International (7/26/79)
Crown Zellerback (10/16/79)
Dayton Hudson Corp. (5/26/82)
Dexter Corp. (11/27/79)
Dravo Corp. (10/21/80)
Eastern Gas and Fuel Association (10/18/79)
Jack Eckert Corp. (5/10/82)
El Paso Co. (2/26/81)
Federal Express Corp. (3/27/80)
First Mississippi Corp. (5/29/80)
Fuqua Industries (11/17/82)
Gannett Corp. (11/15/79)
General Cinema Corp. (7/14/80, 9/8/81)
General Instrument Co. (9/16/80)
General Mills (11/15/79)
Global Marine, Inc. (7/23/81, 8/13/81)
Goulds Pumps, Inc. (9/12/79)
Grace Corp. (7/30/79)
H. J. Heinz Co. (1/24/80)
Harcourt Brace Jovanovich, Inc. (10/31/80)
Hercules, Inc. (2/13/81)
Hoover Universal (1/24/80
IMS International (3/22/82)
International Minerals and Chemicals (8/31/79, 1/7/80, 2/28/80, 10/15/80, 10/21/81, 2/6/82, 10/20/82)
Internorth Inc. (3/27/81)
Jostens, Inc. (1/16/80)
K-Mart Co. (9/20/79)
Kaiser Aluminum & Chemical Co. (10/14/80)
Kemper Corp. (5/21/80)
Knight-Ridder Co. (11/12/81)
Leggett & Platt, Inc. (9/24/79)
Limited, Inc. (11/30/82)
Loral Corp. (8/14/80)
MAPCO (10/6/81)
Manufacturers Hanover Corp. (10/27/80)
MASCO Corp. (10/28/80)
McGraw-Hill Publishing, Inc. (10/9/79)
Medtronic (8/27/80)
Meredith Corp. (9/29/80)
Millipore Corp. (10/13/80)
Nalco Chemical Co. (6/24/82)
Nashua Corp. (6/24/80)
NL Industries (11/28/79)
Nucor Corp. (8/28/79, 11/17/82)
ONEOK, Inc. (6/17/82)
O'Mark Industries (4/8/81)
Orange Rockland Utilities (10/7/81)
Park Electromechanical Corp. (7/22/81)
Pennwalt Corp. (11/28/79)
Petrolane, Inc. (2/12/80, 1/19/82)
Pillsbury Co. (9/15/81)
Portland General Electric (5/14/80)
Raytheon Co. (10/23/81)
Reading & Bates (2/18/82, 4/27/82)
Royal Crown Co. (11/6/80)
Ryder Systems, Inc. (4/9/81)
Scotty's, Inc. (5/7/80)
Smith International (6/23/82)
Southwestern Public Service (5/26/82)
Springs Industries (11/30/79)
Standard Brands Paint Co. (1/25/80, 1/31/80)
Stauffer Chemical Co. (1/28/80, 1/26/81)
Sundstrand Corp. (4/15/82, 5/25/82, 9/28/82)
Tenneco, Inc. (4/23/81)
Texas Oil and Gas Corp. (12/17/81)
Tymshare, Inc. (3/26/81)
U.S. Gypsum (6/9/80, 5/13/81)
U.S. Leasing International (2/11/80, 10/1/81)
Vulcan Materials Co. (6/24/82)
Wang Labs, Inc. (5/10/82)
Whittaker Corp. (9/11/79, 3/27/81, 3/22/82)

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Lobbying Activities and Insider Trading

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ABSTRACT: This study tests whether there is a relationship between the lobbying activities of firms on a proposed accounting standard (FAS No. 19) and the trading activities of corporate insiders. We find that, on average, insiders of full cost firms that lobbied were net sellers and successful efforts lobbiers were net buyers, while non-lobbiers took opposite positions. The results are consistent with the hypothesis that lobbying activity is correlated with management's expected wealth. The results are also consistent with comment letters to the FASB having information value, since insiders trade on their personal account in the same direction their firms lobby. Alternatively, the results can be interpreted as support for the conclusion of Larcker, Reder and Simon [1983] that FAS No. 19 was perceived to have economic consequences.

The purpose of this study is to determine if trading by insiders of firms which lobby the Financial Accounting Standards Board (FASB) is consistent with their lobbying position and significantly different than trading by insiders of affected firms which do not lobby.

The results of this study are useful in addressing three issues. First, several studies in the accounting literature use lobbying positions taken with the FASB as a dependent variable when investigating casual links between cash flows and reported accounting numbers [Watts and Zimmerman, 1978; Dhaliwal, 1980; Kelly, 1982; O'Keefe and Soliman, 1985]. The jointly maintained hypotheses in these studies are:

1. Managers maximize wealth; and
2. Firm lobbying with the FASB is undertaken as part of management's wealth maximization efforts.

This study may be viewed as a test of the latter maintained hypothesis. Acceptance of this hypothesis would increase our confidence in the results of studies using lobbying position to investigate casual links between cash flows and accounting standards.

Second, the FASB acquires a great deal of potential information from firms through comment letters and public hearings. If the trading behavior of lobbying insiders is different from that of non-lobbiers, and the trading is consistent with their lobbying position, this would be *indirect* evidence that comment letters have information value to the FASB.

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There are both theoretical and empirical reasons for skepticism about the information provided during lobbying. Amershi, Demski and Wolfson [1982] show analytically that in multi-period models, "Agents do not necessarily vote their preferences, even when they have no private information to conceal." Kelly [1982, p. 170] concludes that her empirical evidence indicates that information provided by firms lobbying the FASB "may be insufficient or even misleading."

Third, Larcker, Reder and Simon (LRS) [1983] found significantly more trading by insiders of affected firms around the time of a mandated accounting change. Using the maintained hypothesis that insider trading is correlated with management's anticipated wealth, they interpret this result as consistent with insiders perceiving the standard to have economic consequences for them. But if lobbying is also correlated with management's anticipated wealth, then, other things equal, managements that lobby would engage in greater and systematically different trading than non-lobbiers. If true empirically, then our confidence in LRS's interpretations of their findings is increased.

In the next section, research related to the three issues is reviewed. The research design is presented next, followed by results. A brief summary completes the paper.

RELATED RESEARCH

Issue I: Lobbying and Management's Anticipated Wealth

Watts and Zimmerman [1978] used pro and con comment letters on the 1974 FASB discussion memorandum on General Price Level Changes to test whether anticipated managerial wealth may provide an explanation for accounting preferences. The surrogates for wealth effects included those resulting from size, tax, political, and regulatory considerations. Dhaliwal [1980] explored the relationship between a firm's capital structure and its choice of full cost (FC) or successful efforts (SE) accounting for oil and gas exploration expenditures. The accounting choice was assumed to reflect management's wealth-maximizing behavior and hence potential lobbying position. Kelly [1982] classified firms affected by FAS No. 8 regarding foreign currency translation as lobbiers or non-lobbiers depending on whether they sent comment letters to the FASB on the exposure draft for FAS No. 8. Surrogates for anticipated managerial wealth effects, including compensation contracts, capital structure, size, accounting impact, and owner-manager control, were related to lobbying activities. Finally, O'Keefe and Soliman [1985] used the intensity of lobbying positions taken against FAS No. 19 in comment letters on the exposure draft to examine links between accounting numbers and anticipated managerial wealth. The links examined were compensation contracts, capital structure, size, accounting impact, and managerial beliefs about capital market efficiency.

All of these studies have as a maintained hypothesis that management's wealth drives lobbying behavior by firms. This study tests this maintained hypothesis by using an alternative maintained hypothesis: that the effect on management's anticipated wealth from a proposed standard drives its insider trading. Assuming this relationship, if lobbying behavior does not correlate with insider trading, then lobbying is a weak dependent variable in studies investigating the links between accounting numbers and management's anticipated wealth.[1]

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[1] Other possible explanations of a lack of correlation between insider trading and lobbying are discussed later in the paper. If true, these other explanations result in statistical tests of reduced power.

Issue II: The Information Value of Lobbying Comments

If they can be taken at face value, lobbying statements provide the FASB with three types of information. First, the FASB can judge how important the standard is to affected firms as reflected by the number of lobbying comments, the positions taken, and the intensity of the positions taken by lobbyists. Second, since lobbyists usually give reasons for their positions, the FASB may gain some insight as to why a standard is favored or opposed. Third, some lobbyists describe the actions they will take if the standard is passed. Such information might be useful in estimating the economic consequences of the standard.

Kelly [1982] offers some evidence regarding the economic consequences issue. She examined the relationship between lobbying (with comment letters) and changes in investment and financing activity in response to FAS No. 8. No significant relationship was found, although 50 percent of *both* lobbying and non-lobbying firms claim to have changed investment and financing policy. Kelly concluded that relying on comment letters to estimate the resource allocation effects of a standard "may be insufficient or even misleading"[p. 170]. However, this conclusion presumes that managers' *actions* did not follow their lobbying words. Yet, Kelly reports that 50 percent of the lobbying firms claim they acted consistently with their lobbying position.

The present study provides evidence about the information value of the lobbying comments in assessing the importance of the standard to lobbyists. If managers' trades on personal account correlate with their decision to lobby, then lobbying may be a useful measure of the importance of the standard to particular managements and a potential predictor of the actions of firm managers.

Issue III: Inferring Economic Consequences from Insider Trading

LRS [1983] found that immediately after the release of the exposure draft of FAS No. 19, insiders of full cost firms were net sellers of their firms' shares. This was interpreted as evidence that full cost insiders perceived that adverse economic consequences were associated with the proposed accounting change. Their study design uses the maintained hypothesis that *inside trading* is correlated with management's anticipated wealth. Other researchers, as discussed above, have used the maintained hypothesis that *lobbying* is correlated with management's anticipated wealth. If both lobbying and inside trading are associated with manager wealth, then the results of LRS should be driven by the trading of managers of firms that lobbied. If we find no relationship between lobbying and insider trading, LRS's interpretation that inside trading reflects perceived economic consequences will be open to question, since the *assumed* relationship between inside trading and managerial wealth may be incorrect.

If this study finds that the trades of insiders of firms which lobby are in the appropriate direction and greater than the inside trades of firms that do not lobby, the results cannot simultaneously be used to consider all three issues, since issue III treats as maintained the hypothesis that is tested for issues I and II. If inside trading and lobbying are not found to be appropriately correlated, further study would be required to determine whether the lack of a relationship between lobbying and inside trading was the result of no correlation between anticipated management wealth and lobbying or between anticipated wealth and inside trading.

STUDY DESIGN

In this section we first state our hypotheses and then show their importance by discussing motivations for and measurement of both lobbying and insider trading. Our tests involve two hypotheses concerning the direction of trading of lobbiers versus non-lobbiers. The hypotheses follow from findings of previous research showing insiders of full cost firms to be net sellers [LRS, 1983] and all lobbying by FC firms to be *against* the FAS No. 19 Exposure Draft (ED), while lobbying by SE firms was favorable or neutral [O'Keefe and Soliman, 1985]. The two null hypotheses tested are:

H_{01}: Insiders of Full Cost (FC) firms that lobbied against the Exposure draft of FAS No. 19 were no more likely than FC non-lobbiers to take net selling positions in the firms' shares at the time of the ED release.

The alternative hypothesis is that trading positions corresponded with lobbying positions, i.e., FC insiders that lobbied against FAS No. 19 were more likely to sell than were FC non-lobbiers.

H_{02}: Insiders of Successful Efforts (SE) firms that lobbied on the FAS No. 19 ED were no more likely than SE non-lobbiers to take net buying positions in the firms' shares at the time of the ED release.

The alternative hypothesis is again that trading positions correspond with lobbying positions, i.e., SE insiders that lobbied for FAS No. 19 were more likely to buy than were SE non-lobbiers.

Motivations to Lobby FASB Regarding FAS No. 19

An Overview. We assume that managers determine the lobbying activity of their firms and that they maximize their own utility, creating the possibility that their decisions on lobbying activity may not be congruent with shareholder interests. We assume for simplicity that managers' utility depends only upon personal wealth and is a positive function of future wealth and a negative function of the variance of wealth. Wealth from wages, bonuses, and stock options could be affected by an accounting change. If managers believe a proposed accounting standard affects any of these forms of compensation, either now or in the future, they may undertake lobbying activity.

For an accounting standard to be perceived as affecting managerial wealth, the firm's accounting numbers must be affected. FAS No. 19 materially affected accounting numbers for many firms. The standard required firms to expense oil and gas exploration expenditures associated with dry holes. Prior to FAS No. 19, the full cost firms deferred all exploration expenditures, regardless of the success of individual wells. The successful efforts firms already expensed costs related to dry holes, as required by FAS No. 19. The standard was to be applied retroactively, with dramatically negative effects on the stockholders' equity of full cost firms. The average reduction to stockholder equity for full cost firms was estimated to be 22 percent.[2] In addition, Sunder [1976] shows that for growing oil and gas exploration firms, the mean of net income will be lower and the dispersion higher if successful efforts rather than full cost accounting is used. For stable, mature firms the two methods yield approximately the same net income distribution.

Collins, Rozeff and Dhaliwal [1981] discuss reasons why managers might believe their wealth would be affected by FAS No. 19, given the actual and potential changes in their accounting numbers. The reasons include management's assumptions about the efficiency of capital and labor markets, information costs, agency costs, and estimation risk.[3] Assuming managers believe their wealth will be affected by FAS No. 19, they will calculate the net benefits of lobbying based upon the probability of their lobbying affecting the outcome, the costs of lobbying, and the wealth effects of successful lobbying. If the probabilities of successful lobbying and the costs are random across firms, then, on average, firms that lobby are those whose managers expect the greatest effects.[4] Thus, lobbying should be correlated with management's anticipated wealth.

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[2] FAS No. 19 generated intense lobbying pressure and was rescinded in February 1979 after the Securities and Exchange Commission withdrew its support.

H_{01} Compared to H_{02}. Managers of FC firms are likely to anticipate larger wealth changes than managers of SE firms because the accounting effects of the change are much larger for FC firms. In fact, for most SE firms, managers' anticipated wealth effects must come via an improved competitive advantage over FC firms, and that advantage should be distributed over all SE firms. On average, this may weaken the relationship between lobbying and insider trading for SE firms, since there is less variation in the importance of the standard across SE firms. The "weak" lobbying position taken by almost all managers of SE firms is consistent with this decreased variation.[5] Consequently, the likelihood of finding a significant relationship between lobbying and inside trading is higher for FC (H_{01}) than for SE firms (H_{02}).

Measurement of Lobbying Position

In this study, firms were classified as lobbiers if they addressed comments to the FASB either in writing or in public testimony regarding the ED to FAS No. 19.[6] O'Keefe and Soliman [1985] determined lobbying positions concerning FAS No. 19 by reading the comment letters submitted to the FASB in response to the exposure draft. They used independent coders to classify comment letters concerning the ED as strongly for, for, against, strongly against, or neutral. They found that all lobbying by FC firms was *against* the FAS No. 19 ED, while lobbying by SE firms was either neutral (about one-third) or favorable (the remaining two-thirds).[7] Most FC lobbiers said they expected the standard to increase their cost of capital. Presumably, FC managers perceived FAS No. 19 as having a negative effect upon their wealth, while SE managers perceived a positive effect.

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[3] See Holthausen and Leftwich [1983] for a more detailed discussion of the economic consequences of accounting standards.

[4] More complex lobbying models exist. For example, see O'Keefe and Soliman [1985] for an application of Bartlett's [1973] information lobbying model to FAS No. 19. Also, lobbying often involves group activity. For example, firms opposing FAS No. 19 formed a group called the Ad Hoc Committee on Full Cost Accounting and lobbied both the FASB and the Securities and Exchange Commission. Olson [1965] examines collective action of this type. This collective action raises interesting questions, but they are beyond the scope of this paper.

[5] In their lobbying, the FC firms almost always claimed that adoption of the proposal would harm them; however, in no case did any SE firm claim they would be helped [O'Keefe and Soliman, 1984]. While lobbying strategy may dictate this result, our basis for a directional hypothesis relating lobbying and trading position is clearly stronger for FC firms.

[6] In addition, we examined the comment letters and statements on the earlier Discussion Memorandum. For those firms which lobbied on the Discussion Memorandum and not on the ED (seven firms, three FC and four SE), there is some question as to whether they should be classified with the lobbiers or the non-lobbiers on the ED. We believe that lobbying on the issue at any time makes them lobbiers and categorized them accordingly. The results are not greatly affected by their inclusion, but the significance levels are strengthened marginally.

Clearly, comment letters and public testimony to the FASB are only one of the forms lobbying may take. Insofar as the measure of lobbying is incomplete, it leads to misclassifying lobbying firms as non-lobbiers and biases against rejecting the null hypothesis of no difference between lobbiers and non-lobbiers.

[7] Firms are classified as neutral if they took no position regarding successful efforts versus full cost, but commented on other aspects of the standard. Only two of the firms in our sample are classified as neutral. The remaining neutral lobbiers are not part of our sample primarily because, while they had oil and gas interests, they were not primarily oil and gas firms, i.e., Union Pacific, Republic Steel, and New England Electric.

Motivations for Insider Trading

Security traders may have any of several motivations, all consistent with wealth maximization. They may trade to adjust for changes in their preferences or their consumption opportunities, or to adjust their portfolios for changes in risk or return of components of that portfolio. They may also trade on information. In this study we are interested in this information trading. We assume that inside trading to adjust portfolios for risk, return, preference, or opportunity changes is random across FC firms as a group and separately across SE firms as a group.[8]

Information trading surrounding the issuance of the ED may be based on expectations about the *content* of the ED and/or on expectations about its *effect* on individual firms. Predicting the timing of such trading is problematic. Depending on whether the trading is on the "content" or "effect" of the standard and upon the beleifs of insiders concerning capital market efficiency, trading may be either before or after the issuance of the ED. In this paper we investigate trading by insiders both before and after the issuance of the ED for FAS No. 19.

If insiders believe the market is semistrongly efficient and they believe they have private information about the content of the ED and/or the effect of the ED on their firm, trading on the "content" will occur prior to the ED release, but trading on the "effect" may occur either before or after. If insiders do not believe in semi-strong market efficiency, "effect" trading may occur either before or after, but "content" trading will still occur before the ED release.[9]

Information trading after the ED release may, therefore, occur for either of two reasons. First, corporate insiders who believe in semi-strong market efficiency may believe they have private knowledge concerning the effects of FAS No. 19 on their firms and/or the changes in production and investment decisions they will make in response to the standard. Of course the market can estimate these effects, and a market efficient with respect to contracts affecting insiders and the firm may make cross-sectionally unbiased estimates; however, the estimates are likely to be less precise than the estimates of insiders.[10] Firm by firm and based on their private information, managers may rationally perceive the market price to be biased.

Second, insiders may believe the market is inefficient in the semi-strong form. In their lobbying statements most FC lobbiers *said* they did not believe the market to be efficient with respect to publicly available accounting numbers [O'Keefe and Soliman, 1985]. That is, many explicitly stated that their cost of capital would be increased because investors and creditors would misunderstand and/or misuse the changed accounting numbers resulting from FAS No. 19. If these statements accurately reflect their beliefs, then FC and SE insiders might trade to take advantage of a perceived bias in the market, i.e., insiders of FC lobbiers would sell and those of SE lobbiers would buy relative to non-lobbiers in each group.

If our tests result in the rejection of H_{01}

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[8] Note that we do not assume that inside trading to adjust portfolios for risk, return, preference, or opportunity changes is random across FC and SE firms jointly, but only across FC firms as a group and SE firms as a separate group. Therefore, differences in these characteristics between FC and SE firms do not affect the study.

[9] Even if insiders did not believe in market efficiency, it seems perverse to delay trading on private information about ED content until after the ED is released.

[10] Contracts affecting managers and their decisions include, but are not limited to, bonus and compensation agreements and debt covenants. Such contracts may cause managements to change investment and financing decisions because of changes in accounting numbers.

and/or H_{02}, either of the above explanations may be the cause. The data base of this study provides no way of distinguishing between the scenarios.

Measurement of Insider Trading

Since we lack a complete theory of insider trading, it is not clear which of the potential measures of this activity is best. Previous studies [Jaffe, 1974; Finnerty, 1976a, 1976b; Baesel and Stein, 1979; and LRS, 1983] have used both the number of trades and the number of shares traded to define net buying or selling. We use a measure of each. Since we are examining the lobbying of firms, we focus on the insider trading *by firm* for the appropriate time period.

The following measures of insider trading are used in this study:

$$RTD_{it}=\frac{TB_{it}-TS_{it}}{TB_{it}+TS_{it}} \qquad (1)$$

$$RNS_{it}=\frac{B_{it}-S_{it}}{B_{it}+S_{it}} \qquad (2)$$

where

TB_{it} and TS_{it} are the number of insider buy and sell transactions, respectively, for firm i during time period t, and

B_{it} and S_{it} are the number of shares bought and sold, respectively, by insiders for firm i during time period t.

The measures reflect the percentage of total insider trades and shares traded respectively which are purchases (sales if ratio is negative). Obviously these ratios are constrained to the range -1 to $+1$. Both measures are tested because under some circumstances they could lead to different results. If, say, buy transactions are larger on average than sell transactions for a set of firms, trading measures based on number of trades could yield different results than measures based on number of shares. If dramatically different results are found for the two measures, further investigation is warranted. Finally, there is a trade-off in selecting the period to be examined between attenuating the results with too long a period and limiting the observations with too short a period. In this study we examine time periods ranging from ten to 20 days before and after the issuance of the ED.

Insider trading data were obtained from the transactions reported in the *Official Summary of Security Transactions and Holdings* published by the SEC. The total sample of firms used in this study (both lobbying and non-lobbying) is that of LRS [1983] and Lev [1979]. The sample consists of 46 FC firms (17 of which lobbied) and 37 SE firms (17 of which lobbied). Of course, not all firms had insider trades during the period surrounding the release of the exposure draft. Lev's sample excludes firms traded over the counter (OTC), firms not significantly involved in oil and gas exploration, and firms which released other information in the period around the ED issue. The population of firms lobbying the FASB on the issue was examined by O'Keefe and Soliman [1985]. They identified 58 FC lobbiers and 47 SE lobbiers. The restrictions on Lev's sample noted above resulted in the exclusion of some of the lobbying firms.[11]

Interpretation of Results

The maintained hypotheses (assumptions) in our investigation of issues I and II include:

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[11] The major restriction on Lev's sample is that it excludes firms traded OTC. There are both advantages and disadvantages to focusing on listed firms. Problems of thin markets with their increased trading costs and barriers are reduced. Also, issues of corporate control are less likely to influence inside trading. On the other hand, dropping the OTC firms reduces our ability to generalize the results. The collection of inside trading data for this research was resource-intensive and expanding the sample to include OTC firms would have roughly doubled the investment. We do not believe the potential gains justify the cost.

1. Managers maximize personal wealth.
2. Inside trading is correlated with the anticipated wealth effects of the proposed standard.
3. The perceived probabilities of successful lobbying and lobbying costs are random across firms.

Interpretations of the results depend on the validity of these maintained hypotheses. Either incorrect rejection or failure to reject may be due to violations of the assumptions.

The first assumption is common and relatively non-controversial. Next, consider the second maintained hypothesis. We know from LRS [1983] that unusual inside trading occurred around the release of the exposure draft. The question is whether it occurred because of the ED or because of confounding events. If confounding events caused the trading (or caused trading which swamped trading occurring because of the ED), then conclusions cannot be drawn concerning (1) the correlation between lobbying and management wealth and (2) the information value of lobbying statements (issues I and II). Such confounding events would also flaw the LRS study. Therefore, LRS examined two possible confounding events, i.e., trading caused by changes in systematic risk and by exercise stock options. They use Lev [1979, footnote 27] to reject changes in systematic risk as a confounding event; and LRS find no within- or between-sample differences in the exercise of stock options for the FC and SE samples.[12] Therefore, it seems that the most obvious sources of confounding events for insider trades are not a problem for this sample. Of course, other, unidentified confounding events may be.

The third assumption, that lobbying costs and the perceived probabilities of successful lobbying are random across firms, may be of more concern. Suppose, for example, that managers of large firms perceive that they have more influence on outcomes than smaller firms or that they have scale economies in lobbying. Then the *decision* to lobby will reflect management's anticipated wealth, but the actual lobbying activity may not be correlated with anticipated wealth and hence with inside trading because differential lobbying costs and probabilities obscure the relationship. If the third maintained hypothesis is violated as described, our tests are biased *against* rejection of H_{01} and H_{02}.

If H_{01} and H_{02} are not rejected because maintained hypothesis 3 is violated, then studies using the lobbying versus non-lobbying classification as the dependent variable are not viable (issue I). But studies based upon "for or against" lobbying classifications or upon the intensity of the lobbying position may be viable. Further, if maintained hypothesis 3 is violated, then failure to reject H_{01} and H_{02} cannot be used as evidence against the information value of comment letters (issue II). In fact, lobbiers may be more representative of non-lobbiers in that circumstance.

If our maintained hypotheses hold and H_{01} and H_{02} are rejected, we would have evidence that lobbying the FASB is correlated with management's anticipated wealth (issue I) and comment letters and testimony have information value (issue II). An alternative explanation is that maintained hypothesis 3 is so perversely violated that lobbying is negatively correlated with management's anticipated wealth. Such perversity seems extremely unlikely.

Now consider issue III, the relationship between inside trading and economic

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[12] This study further partitions the FC and SE firms into lobbiers and non-lobbiers, so differences in the exercise of options could exist across that partition. However, this seems unlikely given LRS's [1983] within-sample results.

TABLE 1

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING FULL COST FIRMS—
TRADING FIRMS ONLY

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to sell than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Median* (χ^2)	*Savage* (χ^2)	*Wilcoxon* (χ^2)
A. 15 days prior to exposure draft release						
RTD—Lobby	14	.26	.81	.60	.07	.10
—NLobby	12	−.07	(.189)	(.220)	(.457)	(.374)
RNS—Lobby	14	.17	.57	.60	.02	.07
—NLobby	12	−.11	(.229)	(.220)	(.444)	(.405)
B. 15 days after (release date and 14 subsequent days)						
Trading Measures						
RTD—Lobby	8	−.08	1.18	3.02	2.23	1.55
—NLobby	7	.43	(.148)	(.041)	(.068)	(.106)
RNS—Lobby	8	−.20	1.65	3.02	2.23	1.55
—NLobby	7	.43	(.111)	(.041)	(.068)	(.106)

consequences. We investigate issue III by replacing the third maintained hypothesis with:

3.* Lobbying activity is correlated with the anticipated management wealth effects of the proposed standard.

The rejection of H_{01} and H_{02} is the logical consequence of the three maintained hypotheses. If H_{01} and H_{02} are not rejected, then further research is required to determine which of the maintained hypotheses is violated.

RESULTS

The measures of insider trading described in the previous section result in two statistics for each firm for each time period under examination. The basic question is whether there is a relationship between measures of insider trading and the firm's lobbying behavior. The appropriate parametric test is an analysis of variance across the two levels, lobbying and non-lobbying. However, this test assumes that the trading measures are normally distributed. The distribution of the inside trading measures was found to be significantly different from normal, using a Kolmogorov-Smirnov test for normality (P-value$<.01$). Nonparametric tests are useful when the distributional parameters of the population are unknown. Hajek [1969] reports that some tests are more powerful than others for certain population distributions. For example, the median test is most powerful for double exponential distributions, the Wilcoxon test for logistic distributions, the Savage test for exponential distributions, and the Van der Waerden test for normal distributions [SAS, 1982, p. 205]. Since we do not know the exact distribution of our sample, we use several tests and find that the results are consistent across the different tests.

The time periods examined are 10- to 20-day trading periods prior to and subsequent to the release of the exposure draft. The release date is included in the post-

TABLE 2

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING SUCCESSFUL EFFORTS FIRMS—TRADING FIRMS ONLY

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to buy than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Median (χ²)*	*Savage (χ²)*	*Wilcoxon (χ²)*
A. 15 days prior to exposure draft release						
RTD—Lobby	12	.49	.65	.02	.12	.27
—NLobby	9	.17	(.214)	(.451)	(.366)	(.303)
RNS—Lobby	12	.29	.14	.02	.12	.27
—NLobby	9	.13	(.356)	(.451)	(.366)	(.303)
B. 15 days after (release day and 14 subsequent days)						
Trading Measures						
RTD—Lobby	9	.42	1.84	1.73	1.11	1.43
—NLobby	11	−.15	(.096)	(.094)	(.146)	(.116)
RNS—Lobby	9	.24	1.04	1.73	1.11	1.43
—NLobby	11	−.20	(.161)	(.094)	(.146)	(.116)

release trading periods. Tables 1 and 2 report the results for 15-day periods for FC and SE firms, respectively. For FC firms the lobbying and non-lobbying firms differed in their insider trading after the release of the exposure draft (see Table 1, Panel B). Lobbiers' insiders sold, on average, and non-lobbiers' insiders bought. For FC lobbying firms the number of sales (RTD) and shares sold (RNS) exceed the purchases and shares purchased by eight percent and 20 percent, respectively, in the period after the ED release. For non-lobbying firms both the number of purchases and shares purchased exceed the number of sales and shares sold by 43 percent. Significance levels of both measures are between .04 and .11 for all nonparametric tests. There are no differences in trading between lobbiers and non-lobbiers in the expected direction for the period before the ED release. Since no differential trading was found prior to the ED release, it appears that insider trading is not based on private information about the content of the forthcoming ED. We interpret these results as evidence of a relationship between insider trading and lobbying activity for the 15-day period after the exposure draft of FAS No. 19, i.e., we reject H_{01}. Further, since the differential trading occurred after the ED was issued, the results are consistent with the hypothesis that insiders of firms which lobbied against FAS No. 19 traded upon their private information about the specific effects of FAS No. 19 upon their firm.

For SE firms (Table 2) the results are reversed. That is, lobbiers are more likely to be buyers and non-lobbiers to be sellers after the release of the ED. Levels of significance are weaker than for the FC results. The levels range from .09 to .15 for the nonparametric tests of both trading measures.[13] It is possible that insiders of

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[13] Dropping the very small trades (less than 50 shares) strengthens the results for SE firms (and has no effect on the results for the FC firms). As noted in the Study Design section, finding a relationship between lobbying

TABLE 3

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING FULL COST FIRMS—ALL FIRMS

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to sell than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Van der Waer (χ^2)*	*Savage (χ^2)*	*Wilcoxon (χ^2)*
A. 15 days prior to exposure draft release						
RTD—Lobby	17	.21	1.33	1.35	1.87	1.99
—NLobby	29	−.03	(.128)	(.123)	(.086)	(.079)
RNS—Lobby	17	.14	.76	.69	1.25	1.01
—NLobby	29	−.04	(.194)	(.203)	(.132)	(.157)
B. 15 days after (release date and 14 subsequent days)						
Trading Measures						
RTD—Lobby	17	−.04	.82	.57	.23	.46
—NLobby	29	.10	(.186)	(.226)	(.315)	(.250)
RNS—Lobby	17	−.09	1.43	1.57	.60	1.56
—NLobby	29	.10	(.119)	(.105)	(.219)	(.106)

TABLE 4

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING SUCCESSFUL EFFORTS FIRMS—ALL FIRMS

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to buy than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Van der Waer (χ^2)*	*Savage (χ^2)*	*Wilcoxon (χ^2)*
A. 15 days prior to exposure draft release						
RTD—Lobby	17	.35	1.45	1.26	1.49	1.44
—NLobby	20	.08	(.118)	(.131)	(.111)	(.115)
RNS—Lobby	17	.21	.38	.67	1.00	.71
—NLobby	20	.06	(.270)	(.206)	(.159)	(.200)
B. 15 days after (release day and 14 subsequent days)						
Trading Measures						
RTD—Lobby	17	.22	1.80	1.17	.79	1.08
—NLobby	20	−.08	(.094)	(.140)	(.186)	(.149)
RNS—Lobby	17	.13	1.06	1.11	.74	1.02
—NLobby	20	−.11	(.155)	(.146)	(.195)	(.157)

lobbying SE firms (recall that their lobbying was either favorable or neutral to the FAS No. 19 provisions) believed that their competitive positions versus FC

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and inside trading is more likely for FC than for SE firms because the wealth effects are likely to be greater for FC insiders.

TABLE 5

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING FULL COST FIRMS—TRADING FIRMS ONLY

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to sell than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Median (χ^2)*	*Savage (χ^2)*	*Wilcoxon (χ^2)*
A. 20 days prior to exposure draft release						
RTD—Lobby	14	.26	.70	.60	.02	.07
—NLobby	12	−.04	(.206)	(.220)	(.444)	(.394)
RNS—Lobby	14	.18	.46	.60	.03	.05
—NLobby	12	−.07	(.252)	(.220)	(.430)	(.426)
B. 20 days after (release date and 19 subsequent days)						
Trading Measures						
RTD—Lobby	9	.09	2.31	2.78	2.91	2.82
—NLobby	8	.69	(.075)	(.048)	(.044)	(.046)
RNS—Lobby	9	−.05	3.57	2.78	3.03	3.00
—NLobby	8	.71	(.039)	(.048)	(.041)	(.042)

firms would be improved by the standard. Again, no differential trading is found for the period before the release.

The results in Tables 1 and 2 include only those firms for which insider trades occurred during the period. We also performed the analysis including all firms in the sample, but using zero as the value of the trading measures for firms with no insider trading. While this has some appeal since the lack of insider trading results as much from a decision by the insiders as does the presence of such trading, using zeros in the trading measures to represent the decision not to trade introduces some problems. For example, transaction costs are ignored. The results of this additional analysis are reported in Tables 3 and 4. The inclusion of the firms without insider trading inserts a large number of zeros into the distribution of trading measures and would be expected to reduce the significance of the results. Since the tests are tests of differences in the distributions of two samples (lobbiers and non-lobbiers), adding a number of identical observations to each group will reduce the between-sample differences. In addition, the number of tied observations makes the median test inappropriate. Overall, the results are attenuated by the inclusion of the nontrading firms, but indications of the correlation remain. For FC firms the RNS trading measure continues to have three of the four (two of the three nonparametric) tests with significance levels of .12 or below, but the levels for the RTD measure range from .19 to .32. For SE firms the levels for both trading measures range from .15 to .20 for the nonparametric tests.

Longer and shorter trading periods were also examined. Tables 5 through 8 report results for 20 days before and after the ED release. For FC firms, significance levels are increased by using the longer period; however, for SE firms, significance levels are reduced. For time periods of ten days or less the number of observations is considerably reduced, and no differential trading results remain. Within quite a broad range between, however,

TABLE 6

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING SUCCESSFUL EFFORTS FIRMS—TRADING FIRMS ONLY

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to buy than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Median* (χ^2)	*Savage* (χ^2)	*Wilcoxon* (χ^2)
A. 20 days prior to exposure draft release						
RTD—Lobby	13	.36	.23	.01	.00	.03
—NLobby	9	.17	(.320)	(.469)	(.473)	(.427)
RNS—Lobby	13	.19	.02	.01	.00	.03
—NLobby	9	.13	(.450)	(.469)	(.473)	(.427)
B. 20 days after (release day and 19 subsequent days)						
Trading Measures						
RTD—Lobby	9	.31	1.22	.19	.47	.87
—NLobby	11	−.15	(.142)	(.331)	(.246)	(.175)
RNS—Lobby	9	.13	.62	1.73	.56	1.03
—NLobby	11	−.20	(.221)	(.094)	(.227)	(.155)

TABLE 7

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING FULL COST FIRMS—ALL FIRMS

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to sell than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Van der Waer* (χ^2)	*Savage* (χ^2)	*Wilcoxon* (χ^2)
A. 20 days prior to exposure draft release						
RTD—Lobby	17	.21	1.22	1.22	1.72	1.80
—NLobby	29	−.02	(.137)	(.134)	(.095)	(.090)
RNS—Lobby	17	.15	.70	.57	1.09	.83
—NLobby	29	−.03	(.204)	(.226)	(.148)	(.181)
B. 20 days after (release date and 19 subsequent days)						
Trading Measures						
RTD—Lobby	17	.05	.74	.47	.07	.26
—NLobby	29	.19	(.196)	(.248)	(.395)	(.305)
RNS—Lobby	17	−.03	1.75	2.02	.55	1.82
—NLobby	29	.20	(.096)	(.078)	(.228)	(.089)

the results do not appear sensitive to the trading period chosen.

Finally, the analysis reported in this study was repeated for the release of the Discussion Memorandum concerning oil and gas accounting on December 23, 1976. These results were not reported since no differences in the trading activi-

TABLE 8

TESTS OF INSIDER TRADING OF LOBBYING VERSUS NON-LOBBYING SUCCESSFUL EFFORTS FIRMS—ALL FIRMS

			Statistics and (p-values) for rejection of the hypothesis that lobbying insiders were no more likely to buy than non-lobbiers			
Trading Measures	*No. Firms Trading*	*Mean of Trading Measure*	*ANOVA (F)*	*Van der Waer (χ^2)*	*Savage (χ^2)*	*Wilcoxon (χ^2)*
A. 20 days prior to exposure draft release						
RTD—Lobby	17	.27	.71	.64	1.16	.81
—NLobby	20	.07	(.202)	(.212)	(.141)	(.184)
RNS—Lobby	17	.14	.11	.25	.73	.30
—NLobby	20	.06	(.368)	(.308)	(.197)	(.292)
B. 20 days after (release day and 19 subsequent days)						
Trading Measures						
RTD—Lobby	17	.17	1.22	.71	.31	.64
—NLobby	20	−.08	(.138)	(.200)	(.289)	(.211)
RNS—Lobby	17	.07	.65	.51	.20	.42
—NLobby	20	−.11	(.213)	(.237)	(.326)	(.258)

ties of the lobbying and non-lobbying firms were found. The set of firms lobbying on Discussion Memorandum overlaps considerably those lobbying on the ED, but they are not identical.

This study has several limitations which have been discussed. First, the sample is confined to publicly traded, listed firms. Second, the lack of a theory of insider trading makes it difficult to (1) specify when trading will occur, (2) identify confounding events, and (3) specify the appropriate statistical tests. Third, the lobbying activity analyzed is restricted to public statements and letters to the FASB.

SUMMARY

In this study we find that insiders of full cost (FC) firms that lobbied the FASB regarding the discussion memorandum or exposure draft of FAS No. 19 were net sellers near the exposure draft release date compared to FC insiders who did not lobby. Likewise, successful efforts (SE) insiders who lobbied were net buyers relative to SE insiders who did not lobby.

In our opinion, the results are consistent with the maintained hypothesis that lobbying activity is correlated with management's anticipated wealth. As such, they increase our confidence in studies that rely on this maintained hypothesis when using lobbying of the FASB as a dependent variable.

The results are also consistent, in our view, with comment letters to the FASB having information value. This study indicates that insiders trade on their personal account in the same direction their firms lobby. Kelly [1982] found that 50 percent of the firms that lobbied followed their lobbying with an action appropriate to their lobbying position. Taken together, the two studies suggest that valuable information is provided to the FASB through comment letters. Alternatively, these results can be interpreted as a validity test whose results support Larcker, Reder and Simon's [1983] conclusion that FAS No. 19 was perceived to have economic consequences.

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Uses of Indexes and Data Bases for Information Release Analysis

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ABSTRACT: This study assesses the relative effectiveness of searches of the *Wall Street Journal Index* and *Dialog* data base searches for information release analyses. The results indicate that the *Wall Street Journal Index* is more effective than *Dialog*, but a substantial number of information events do not appear in either service. In addition, the *Wall Street Journal Index* searches found a large number of financial type announcements but found only about 35 percent of nonfinancial items. Stock price data are presented which indicate that items not appearing in the *Wall Street Journal Index* are as likely to occasion significant price reactions as items which do appear in the *Index*.

MANY accounting research studies use security price performance to test hypotheses about accounting information or policy decisions. Despite the widespread use of the approach, a number of basic problems exist. Two of these problems are event date uncertainty and identification of confounding events. A common approach for dealing with both of these problems is to search indexes of financial publications. This frequently involves a search of the *Wall Street Journal Index* or the use of a computerized data base search such as the *Dialog Information Retrieval Service.*[1] The purpose of this paper is to provide information regarding the use of *Wall Street Journal Index* searches and computerized data base searches for identification of events. The results presented here indicate that a substantial number of information events do not appear in the *Wall Street Journal Index* or in the *Dialog* computerized data base.

Commonly, two types of events are identified in security price-based research: 1) those in which the event date is common to all firms in the test sample (e.g., Collins and Dent [1979] and Lev [1979]), and 2) those in which the event date is unique to each firm in the test sample (e.g., Banks and Kinney [1982] and Dodd, et al. [1984]). Identification of the firm-specific event date is a basic problem in this latter group of studies. Failure to identify the announcement/event date accurately may

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[1] References to searches of the *Wall Street Journal Index* indicate a by-hand search while references to data base searches (i.e., *Dialog*) refer to computerized searches such as those offered by the *Dialog Information Retrieval Service.*

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result in the researcher missing a significant stock price reaction altogether. The usual response to event date uncertainty is to widen the test period window (i.e., include more days around the suspected event date in the test period). As the test period is lengthened in an attempt to capture the effects of the announcement of the event of interest, additional observations of security price movements for days on which no abnormal response would be anticipated are averaged with the response on the uncertain event date. This averaging process tends to lessen the likelihood that abnormal returns associated with the event announcement will be detected [Brown and Warner, 1980, p. 225].

Increasing the window width has the additional disadvantage of increasing the likelihood that security price responses which are abnormal but unrelated to the event of interest will be included in the test period. Any event which occurs during the test period but which is unrelated to the event of interest is a confounding event. These confounding events create problems when they result in abnormal security price movements for any one or all of the firms used in a test. Studies using either sample-wide or firm-specific event dates may suffer from the effects of confounding events.[2] Sample-wide confounding events are often more easily identified and an appropriate adjustment to the research design can compensate for their effects.[3] The difficulties, therefore, are typically associated with firm-specific confounding events.

Researchers have attempted to deal with confounding events in various ways. Lev [1979] argues that using a shortened test period eliminates, at least partially, the difficulties of testing for abnormal returns when confounding events are present. Alternatively, Dyckman and Smith [1979] assume that other information events (besides the policy decision being tested) are either random in their impact, are of insignificant consequence, or are controlled for by the research design (in the case of sample-wide announcements). Other research attempts to deal with confounding events include Gonedes [1969], Ro [1980], Leftwich [1981], Sepe [1982], Collins, Rozeff and Salatka [1982], Bell [1983], and Schipper and Thompson [1983]. In arguing that additional attention should be paid to confounding events, Foster [1980] outlines five approaches which can be used to deal with the problem of confounding events. These include: (1) testing categories of events to determine which types are likely to create problems and partitioning sample firms into event-type portfolios; (2) deleting from the sample any firm experiencing a confounding event; (3) deleting appropriate observations when confounding events occur; (4) retaining all firms and all dates and subtracting the estimated effects of confounding events; and (5) assuming that the effect of confounding events is minimal or otherwise controlled for and ignoring them. Clearly, all of these except the last one require the successful identification of the confounding event. This is no less difficult than is the successful identification of the appropriate event date on which a study is to focus.

Refinement of capital market research

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[2] For example, if one were investigating the impact of the release of the *Exposure Draft* concerning oil and gas accounting on the share prices of companies using the full cost accounting method (a sample-wide event), confounding events could include the report of a company's major oil discovery in the Gulf of Mexico or the announcement that an extremely costly venture had been abandoned due to negative testing results (individual firm confounding events), or the actions of OPEC or the elimination of percentage depletion as a means of computing deductions for federal income tax purposes (sample-wide confounding events).

[3] For example, investigators often incorporate an industry parameter in the familiar market model to compensate for the effects of industry-wide confounding events. For example, see Bell [1983].

has led to design modifications incorporating measures to control for event date uncertainty and/or confounding events. Information release analysis has become a critical step in developing research design and testing configurations. An information release analysis [Foster, 1980, p. 53] involves searching for information items released by or relating to sample firms. The procedure includes searches of such news-related indexes as the *Wall Street Journal Index*, the *Dialog Information Retrieval Service*, or the *Dow Jones News/Retrieval*.

There is no lack of examples of studies where such searches are used as part of the research and test procedures. Chambers and Penman [1984] and Foster [1981] are only two of many studies which use the *Wall Street Journal Index* as a source of earnings announcements dates. Smith, Stettler and Beedles [1984] use it to isolate the date of sensitive payment disclosures and Banks and Kinney [1982] use it to determine the date of disclosure of an event which gives rise to a loss contingency. Grant [1980] searches the *Wall Street Journal Index* for interim news stories which he defines as information events. Collins and Dent [1979] and Lev [1979] perform searches of the *Wall Street Journal* to search for confounding events. Dodd, et al. [1984] rely on a search of the *Wall Street Journal Index* and the *Dow Jones News/Retrieval* in developing their strategy for identifying firms' first disclosure of a qualified audit opinion. Foster [1980] specifically suggests the *Dialog Information Retrieval Service* as a source for information items released by publicly traded firms.

RESEARCH METHOD

Data and Event Identification

Despite the widespread use of various aspects of the information release analysis procedure, little research has been done related to its efficacy. However, a first step in this research is to determine how successful the various approaches to information release analysis are at identifying information events. Consequently, in this study we identify a group of information events. We then determine how frequently these same events appear either in the *Wall Street Journal Index*, or on the *National Newspaper Index* data base of the *Dialog Information Retrieval Service*. Our evidence indicates that a significant number of information events which, according to company records, have been published in the press media, do not appear in either the *Wall Street Journal Index* or in the *Dialog* data base. Furthermore, there is evidence that certain types of information events are much less likely to appear as a result of an information release analysis using one of these sources than are other types of events.

The first step in the test procedure was to identify from company records a set of news announcements relating to a sample of companies. Initially, all independent oil and gas companies with home offices in Dallas, Fort Worth, and Houston were contacted to determine whether they employed press clippings services or otherwise maintained press files. Personal visits were made to those companies indicating that such information was available. Eight companies (listed in Table 1) which maintained extensive press files were selected for further analysis.[4] The press files of each of these companies were thoroughly read and analyzed. These files

[4] We computed deciles based on total assets for all firms on Compustat for the years 1979 and 1980. The ranks of the sample firms were essentially the same for the two years. For 1980, one firm fell in the ninth decile, two each in the eighth, seventh, and sixth deciles, and one firm fell in the fourth decile. This indicates that the sample firms were, in general, larger than the typical firm; however, there appears to be sufficient variation in size so that the test results do not suffer from a size bias.

TABLE 1

COMPANY-BY-COMPANY SUMMARY OF TYPES OF ANNOUNCEMENTS FROM ALL SOURCES

	Type of Announcements				
Company	*Financial*	*Personnel*	*Explorational*	*Operational*	*Total*
General American Oil Co.	15	4	4	3	26
Mitchell Energy Co.	34	14	7	30	85
Sabine Corp.	20	3	5	11	39
Southland Royalty Co.	22	3	2	16	43
Superior Oil Co.	28	4	16	8	56
Texas Oil and Gas Corp.	26	1	5	9	41
Universal Resources Corp.	13	0	5	3	21
Wainoco Oil and Gas Co.	27	4	16	8	55
TOTAL	185	33	60	88	366

contained published articles from numerous sources.[5] Each press file item from the period January 1, 1979, to December 31, 1980, was logged and information recorded as to the nature of the underlying event(s). The authors are aware that industry concentration may present limitations on the generalizability of these results.

Where multiple articles from various publication sources and covering the same event were present, a single announcement was logged and the date of the initial observation noted. The announcements were chronologically ordered and later classified as being either financial, personnel, explorational, or operational in nature. A summary of the types of announcements assigned to each category appears below. A total of 308 separate events were identified from company files for the eight companies in the sample.

Financial	earnings announcements, dividends information, news of debt or equity financing arrangements, etc.;
Personnel	announcements of major personnel changes;
Explorational	news of the results of drilling in an exploratory area, plans to enter an exploratory area or information concerning undeveloped properties;
Operational	announcements of operating activities in developed areas, results of development drilling, news regarding ongoing projects, equipment or properties.

The second step in the test was to perform a search of the *Wall Street Journal Index*. Each company entry was searched in both the 1979 and 1980 indexes. Because news items appearing in late 1980 may have been indexed in 1981, the 1981 *Index* was also searched for 1980 news items. Each index item relating to a sample company was logged and classified as to type using the scheme described above. A total of 205 references to the sample companies were identified from the *Wall Street Journal Index*.

Finally, a computerized search of the *National Newspaper Index* data base of the *Dialog Information Retrieval Service* was performed. This data base includes index-type data from major news sources such as the *Wall Street Journal*, the *New York Times*, and the *Christian Science Monitor* from January 1, 1979, to the present with updating occurring at six-month intervals. Company names, abbreviated

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[5] Press releases which, according to the clippings files, did not result in a published article, were excluded from the analysis. Specific sources of articles in the company files were frequently indeterminable.

TABLE 2

COMPARISON OF TYPES OF ANNOUNCEMENTS AND SOURCES OF INFORMATION

		On Dialog		Not on Dialog		
		In WSJ Index	*Not in WSJ Index*	*In WSJ Index*	*Not in WSJ Index*	*Total*
In Company Files	Financial	34	3	70	31	138
	Personnel	1	0	1	29	31
	Explorational	8	3	9	37	57
	Operational	17	6	10	49	82
	Total	60	12	90	146	308
Not In Company Files	Financial	14	1	32		47
	Personnel	0	1	1		2
	Explorational	0	0	3	*	3
	Operational	1	1	4		6
	Total	15	3	40		58
TOTAL		75	15	130	146	366

* No announcements appear in this cell, as the sources indicated were the only sources consulted.

versions of company names, and stock ticker symbols were used as key words for the search. As with the *Wall Street Journal Index* hand search, 1979, 1980, and 1981 records were searched for items appearing in 1979 or 1980. A total of 90 items pertaining to the sample companies during the test period were identified from this search.

The announcements identified from the three procedures were matched. Dates as well as the contents of the announcements were used in the matching. The dates alone could not be used since regional or local newspaper announcements (from company files) normally preceded the announcement appearing in the national press by one day.[6] The results of this comparison are reported in Table 2.

Table 2 indicates the extent to which announcements were identified by the three alternative searches. Of the 366 news items identified from the three sources, 308 (84 percent) would have been identified from the company files alone, 205 (56 percent) would have been identified by the *Wall Street Journal Index* search alone, and 90 (24.6 percent) would have been identified by the *Dialog* search alone. Of the 308 news items identified by the companies' files, a *Wall Street Journal Index* search alone would have missed 158 (51.2 percent) of those items and a computerized data base search alone (i.e., *Dialog*) would not have found 236 (76.6 percent) of those items.

Additionally, it appears that not all types of new items are equally likely to be identified through a *Wall Street Journal Index* or computerized data base search. While 107 (77.5 percent) of all the financial items in the company files were found through one of the other searches, only two (6.5 percent) of the personnel items, 20 (35.1 percent) of the explorational items, and 33 (40.2 percent) of the operational items were found in those searches. This suggests that a *Wall Street Journal Index* or *Dialog*-based release analysis may be successful in identifying such financial news items as earnings announcements. However, such an approach is likely to miss substantial numbers of other types of items. Normally, in accounting capital market studies, these types of announcements might be classified as confounding events. In a study specifically investigating the abnormal returns relating to various types of news announcements of oil and gas producing companies, explorational and operational type announcements were determined to have a significant effect on stock price performance [Wright, 1982].

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[6] These lags are consistent with those reported by Abdel-khalik [1984].

Of the 58 announcements not in company files, 40 were identified solely by the *Wall Street Journal Index*. An examination of these announcements revealed that 32 were financial-type announcements. These financial announcements were consistently of three types: those dealing with security analysts' or brokers' comments and opinions, articles regarding the industry in general with a specific reference to a sample firm, or a listing in the "Earnings Summary." Earnings announcements were, however, consistently identified by both company files and the *Wall Street Journal Index*.

Only three announcements were identified solely by the *Dialog* search. Of these, one was financial, one was personnel, and one was operational-related. The *Dialog* search was never more successful than the *Wall Street Journal Index* search in identifying announcements (in total nor by specific type). This appears to indicate that some form of editing or perhaps a completely independent indexing of information is performed by the preparer of the *Dialog* data base. Identical key words were used for both searches. Additionally, and perhaps more importantly, the search of company files consistently yielded substantially more announcements than the *Wall Street Journal Index* search.

To ascertain whether the announcements identified from the company files and not appearing in the *Wall Street Journal Index* were indeed not in the *Wall Street Journal*, a random sample of 30 such announcements was drawn. Issues of the *Wall Street Journal* published the day before, the day of, and for the two days following the sample announcement were searched. The results of this search were negative, that is, no news stories were found. Thus, it was concluded that announcements identified from the company files and not appearing in the *Wall Street Journal Index* were indeed not in the *Wall Street Journal*. It is clear that the editing process which a national newspaper such as the *Wall Street Journal* must undertake tends to to filter out a substantial number of news items which are available to securities market agents through other sources. Since market efficiency, at least in the semi-strong form, is well accepted, this publicly available information is likely to be reflected in stock prices. Clearly, the usual manner in which an information release analysis is performed may fail to identify a substantial number of potentially confounding events. Given these results, the next question is whether the announcements which were missed by the *Index* and data base searches result in abnormal return behavior. This is a question of importance, since abnormal return behavior related to undetected events might be interpreted by accounting researchers as relating to a specific information event being studied, thus resulting in faulty research conclusions. However, if the undetected events are significantly less likely to result in abnormal return behavior than the items which were detected, searches of the *Wall Street Journal Index* and the computerized data base may well be a reliable method of detecting confounding events. To answer this question, a set of statistical procedures was performed.

Stock Price Response to News Announcements by Source

The market model was used initially to identify abnormal returns. According to this model, an individual security return for a particular date is described by the equation:

$$R_{it} = a_i + B_i(R_{mt}) + e_{it} \tag{1}$$

where

a_i, B_i = regression coefficients representing firm-specific constants,

R_{it} = the return on the stock of firm i in period t,

R_{mt} = the return on the market in period t, and

e_{it} = a residual reflecting that portion of security i's return which varies independently of the market return in period t.

To establish values for the model parameters, regressions were performed for each firm using an estimation period consisting of all daily returns for the years 1979 and 1980 with the exception of returns for the day before, the day of, and the day after (days −1,0,+1) any identified announcement date. Individual firm and market returns were gathered from the daily CRSP tapes.

For each firm, return residuals were calculated for each day of each event period (i.e., days −1,0,+1). The unexpected returns for the days surrounding a particular announcement day were calculated using

$$u_{i,t+j} = \sum_j [R_{i,t+j} - (\hat{a}_i + \hat{B}_i R_{m,t+j})] \qquad j = -1,0,+1 \tag{2}$$

where all variables are as described above, and $u_{i,t+j}$ is the residual or unexpected return which occurred on day $t+j$. All dates which would have resulted in overlapping three-day event periods were eliminated from the sample. Since so few announcements were identified solely by the *Dialog* searches, no residuals were computed for these dates. Of the 366 identified announcements, 81 were eliminated from the analysis for one of these two reasons.

Recall that the question being addressed is whether announcements which appeared in the *Wall Street Journal Index* are more likely to be associated with extreme residual values than are announcements which would have been identified only through a search of company files. In the absence of any information effect resulting from an announcement, regardless of source, the residuals in the event period should be distributed the same as those from the estimation period. Because of the large number of observations in the estimation period, the distributions of residuals for all firms are reasonably approximated by a normal distribution with a mean of zero. Absolute standardized residuals (ASRs) were computed as

$$ASR_{i,t+j} = |u_{i,t+j}/\hat{\sigma}_i| \tag{3}$$

where the standard error ($\hat{\sigma}_i$) is calculated using the residuals from the estimation period.

Defining as "extreme" any ASR value which exceeded 1.282,[7] we identified the number of announcement periods for which at least one daily ASR from that period exceeded the threshold level. These results are presented in Table 3.

ASRs were computed for a total of 156 and 129 announcements appearing in the

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[7] In the absence of any information effect, 20 percent of the ASRs would be expected to fall beyond ±1.282. Other values were used (i.e., 1.645 and 1.960), with no impact on the results which follow.

TABLE 3

NUMBER OF EVENT PERIODS IN WHICH AT LEAST ONE DAY REALIZED AN ABSOLUTE STANDARDIZED RESIDUAL GREATER THAN OR EQUAL TO 1.282

Source	*Financial*	*Personnel*	*Explorational*	*Operational*	*Total*
Wall Street Journal Index	55	0	4	13	72
(Total Items)	(116)	(3)	(11)	(26)	(156)
Company Files Only	9	5	18	25	57
(Total Items)	(25)	(22)	(35)	(47)	(129)

Note: 78 items were not used because of overlapping event periods and 3 items were not used because they only appeared on Dialog. The original 366 announcements are classified as follows:

Used:	In the *WSJ* Index	156
	In company files only	129
Not used:	Overlapping event periods	78
	Appear only in Dialog	3
		366

Wall Street Journal Index and in the company files, respectively. Of these, 72 *Wall Street Journal Index* announcements and 57 company files announcements were associated with extreme ASR values.

To test for differences in the frequency with which large absolute residuals are associated with announcements identified from the *Wall Street Journal Index* versus those which were identified only through the company files, a series of two-by-two contingency table analyses was constructed. The chi-square value for the test of all 285 announcements (see Figure 1a) was $x^2 = .045$ which, with one degree of freedom, is not significant at the .10 level of significance. Similar tests were performed individually for the financial announcements (Figure 1b) ($x^2 = .670$), explorational announcements (Figure 1c) ($x^2 = .277$), and operational announcements (Figure 1d) ($x^2 = .000$). Personnel announcements were not analyzed as a chi-square test is inappropriate when cell values are zero [Siegel, 1956, p. 109].

Stated as a null, the hypothesis being tested in each two-by-two contingency table analysis is that the number of large stock price reactions associated with announcements appearing in the *Wall Street Journal Index* is not different from the number of large stock price reactions associated with announcements *not* appearing in the *Index*. This difference would be evidenced by significantly large chi-square values. None of these chi-square values is significant at an $\alpha = .10$ level or better. Thus, we find no indications that extreme ASR values are more likely to be associated with announcements identified from the *Wall Street Journal Index* than with announcements *not* in the *Wall Street Journal Index* (i.e., solely from the company files). What these results show is that the set of items appearing in the *Wall Street Journal Index* does not include all news items which are of interest to market participants.

CONCLUSIONS

The results of this study have implica-

FIGURE 1

CONTINGENCY TABLES USED IN THE ABSOLUTE STANDARDIZED RESIDUAL (ASR) ANALYSIS

ALL ANNOUNCEMENTS:

		ASR Value Exceeds 1.282		
		Yes	No	
In the *WSJ Index*	Yes	72	84	156
	No	57	72	129
		129	156	285

Figure 1a.

FINANCIAL ANNOUNCEMENTS:

		ASR Value Exceeds 1.282		
		Yes	No	
In the *WSJ Index*	Yes	55	61	116
	No	9	16	25
		64	77	141

Figure 1b.

EXPLORATIONAL ANNOUNCEMENTS:

		ASR Value Exceeds 1.282		
		Yes	No	
In the *WSJ Index*	Yes	4	7	11
	No	18	17	35
		22	24	46

Figure 1c.

OPERATIONAL ANNOUNCEMENTS:

		ASR Value Exceeds 1.282		
		Yes	No	
In the *WSJ Index*	Yes	13	13	26
	No	25	22	47
		38	35	73

Figure 1d.

tions for researchers attempting to deal with event date uncertainty and/or confounding events. Researchers should be aware that the *Wall Street Journal Index* and computerized services such as the *Dialog National Newspaper Index* data base may enable them to identify substantially fewer announcements than actually occurred. Furthermore, market price data indicate that abnormal returns are as likely to be associated with announcements not appearing in the *Wall Street Journal Index* as with announcements which do appear in the *Index.*

The results also indicate that the *Wall Street Journal Index* is much more likely to identify financial-type announcements than other types of news. Since accounting research is typically concerned with the stock market response to financial events, an information release analysis using the *Wall Street Journal Index* appears to be a reasonable tool for dealing with event date uncertainty.

In accounting event studies, nonfinancial announcements are likely to be confounding events. The residual analysis indicates that nonfinancial announcements are also frequently associated with abnormal returns. While information release analyses using either searches of the *Wall Street Journal Index* or computerized data base searches would appear to be efficient means of identifying confounding events, we find that they commonly fail to identify nonfinancial announcements. While industry concentration may present limitations on the generalizability of these results, researchers seeking to identify all announcements appearing during a specific time period (as would typically be the case with confounding events) should consider using other sources (i.e., company records, other newspaper indexes, or the *Dow Jones Broad Tape*) to supplement their searches.

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NOTES

Anchoring in the Judgmental Evaluation of Audit Samples

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ABSTRACT: This study reports the results of two experiments designed to determine the anchor used by experienced auditors in their judgmental evaluation of a compliance test sample and a substantive test of details sample. Kinney and Uecker [1982] suggest that auditors use even odds as an anchor when evaluating compliance test samples. However, there are a number of other possible anchors. For instance, in a compliance test the auditor may also anchor on the tolerable error rate or an expectation of what will be found. The experiments reported in the following study discriminate among alternative explanations (anchors). The results indicate that there is anchoring behavior, but rather than showing that even odds or that a value stated in the problem is the anchor, it appears that experienced auditors make assessments of risk by starting from an "internal anchor" of five to ten percent.

MUCH research in auditing has focused on auditors' use of decision heuristics and the potential dysfunctional consequences implied by their use.[1] One of these heuristics is anchoring and adjustment [Tversky and Kahneman, 1974]. When the anchoring heuristic is used, an initial estimate is followed by an insufficient adjustment as more information is considered. The problem for the auditor comes about when the initial estimate is on an irrelevant piece of information or when there is an insufficient adjustment from relevant information.

The use of the anchoring heuristic may result in costly over- or under-auditing. For example, costly under-auditing may occur when an auditor allows a previous judgment to affect a current one. Joyce and Biddle [1981] used a task in which the auditor first made an assessment of the extent of substantive tests based on strong internal control and then another assessment based on weak internal control. If an auditor anchors on the assessment provided in the strong internal control case and does not make a sufficient adjustment based on the information that certain controls are absent, under-auditing will result. This decreases the effectiveness of the audit through overreliance on internal control [AICPA, 1981, paragraph 14]. Kinney and Uecker [1982] provided an example of how probability elici-

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[1] See Ashton [1982], Libby [1981], and Biddle and Joyce [1980] for a review of this literature.

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tation methods used to assess the risk of overreliance or incorrect acceptance due to sampling (hereafter called risk) may lead to under-auditing. Because different elicitation methods may induce the use of different anchors, certain methods tend to lead to an increase in Type I errors, while others lead to an increase in Type II errors. Since anchors can be manipulated by the audit policy setter, the determination of extant anchors is important in order to mitigate the effects of inappropriate anchors and so that effective decision aids may be developed.

This paper reports the results of two experiments that test for various possible anchors as well as for what seems to affect the anchoring heuristic's use in the assessment of risk by auditors. The primary experiment focuses on the assessment of risk in a substantive test of details task in which the accounts receivable balance is tested for overstatement using confirmations. It tests the prediction of the anchoring and adjustment heuristic in a task that is more likely than a compliance test to be assessed judgmentally, and therefore, to be subject to bias. Moreover, in this task there are a number of possible anchors, each of which will be tested. Finally, by examining situations that may be evaluated statistically (e.g., using dollar-unit sampling) or judgmentally, it may be possible to infer what biases may exist in analytical review contexts where no statistical model is available.

The secondary experiment involves a situation in which an auditor is testing for compliance with a prescribed internal accounting control. Its purpose is to test the possibility that the anchor is even odds (50 percent risk) when a direct risk assessment is made [Tversky and Kahneman, 1974]. The design of the experiment will allow for a more robust test of the anchoring and adjustment heuristic than was possible in Kinney and Uecker's [1982] experiment.

The remainder of the paper is organized as follows. The next section reviews the evidence on the use of the anchoring heuristic. This is followed by a section describing the research method. The fourth section presents the results and the fifth section discusses the results. An appendix describes the procedures and results of the compliance test experiment.

ANCHORING HEURISTIC

Tversky and Kahneman [1974] were the first to identify and label the anchoring and adjustment heuristic. The origin of the initial value or anchor is not clear, but they stated that it may result from a partial computation or from the formulation of the problem. In the auditor's judgmental evaluation of risk, any computations are likely to be carried out in full so only the formulation of the problem (or experience)[2] can generate the anchor.

One way in which the problem formulation may provide an anchor that is normatively irrelevant is to ask whether the true value of the unknown is more or less than *x*. Tversky and Kahneman [1974, p. 1128] found that students anchored on an obviously arbitrary number when estimating the true value. Joyce and Biddle [1981] have found similar behavior using experienced auditors. However, they did not find that the anchoring effect was a monotonically increasing function of the magnitude of the anchor. That is, the auditors were less likely to be influenced by extreme values of the predicted anchor.

Formulation of the problem may also cause anchoring in the assessment of subjective probabilities (e.g., risk). Specifically, the probability elicitation method used may cause different initial values to be used. Tversky and Kahneman [1974, p. 1129] focused on two common probability elicitation methods:[3] the fractile method and the direct risk method. In assessing various fractiles of a distribution, they predicted that the initial estimate would be the best estimate of the unknown quantity, with subsequent adjustment that would be insufficient resulting in narrowed confidence intervals. There were two possible anchors when the direct risk assessment method was used. First, when someone was asked to assess the probability that the true value exceeded a stated value, the stated value may have become the anchor. On the other hand, Tversky and Kahneman [1974] stated that a natural starting point in the estimation of likelihood is 50 percent risk with an adjustment either up or down depending on the other information.

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[2] Tversky and Kahneman did not identify experience as a factor in determining an anchor, but for the assessments required, all of their subjects were novices.

Kinney and Uecker [1982] tested the anchoring prediction in a subjective probability task that required the assessment of fractiles and a direct risk assessment. Using auditors in a compliance sample evaluation task, they predicted that the auditors would anchor on the sample error rate in the fractile method and on even odds in the direct risk method. Their results were consistent with the anchor on the sample error rate. However, the anchor in the direct risk assessment method was less clear. For example, when the responses were classified by the specific case,[4] two of the four cases had median risk assessments below the statistical evaluation, which is contrary to the prediction of 50 percent risk.[5]

There are at least two other anchors that could explain Kinney and Uecker's [1982] results. First, information provided in the task is more likely to be used than information that must be retrieved from memory or transformed [Slovic, 1972]. Kinney and Uecker made prominent use of a tolerable error rate of eight percent (see Figure 2 [1982, p. 60]) in the risk assessment form of their compliance sample task. It is possible that the auditors anchored on eight percent, and then adjusted the risk estimate based on the sample error rate and the sample size. As a matter of fact, an examination of the median response of the auditors shows that an eight percent anchor would predict the results in all four risk assessment cases, rather than in only two of the four.[6]

In a compliance test setting, the auditor must know the tolerable error rate, and also may know the allowable risk of overreliance on the internal accounting control [AICPA, 1981, paragraph 12]. If both are stated in the problem, either one could conceivably serve as an anchor, although since both are stated as percentages, it is virtually impossible to distinguish statistically between an anchor on the allowable risk or the tolerable error rate. On the other hand, in the substantive test of details setting, it is possible to investigate an anchor on the allowable risk because the tolerable error is a dollar amount rather than a percentage.

Second, it is possible that auditors judgmentally evaluate a sample expecting a particular result. This internal expectation (anchor) may result from experience and from institutional guidance on what

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[3] For a discussion of a number of different probability elicitation methods, see Chesley [1975].

[4] Kinney and Uecker [1982] had two levels of both sample size (40 and 80) and number of errors (zero and two).

[5] The two cases were when the sample error rate was five percent. In one case, the sample size was 40 with two errors, while the other case had a sample of 80 with four errors.

[6] Table 3 in Kinney and Uecker [1982, p. 64] reported the following when the direct risk assessment method was used.

Case	*Median Response*	*Statistical Evaluation*
$n=40, e=0$	6.0%	4.1%
$n=40, e=2$	30.0%	38.0%
$n=80, e=0$	5.0%	.2%
$n=80, e=4$	10.0%	23.5%

The median response in all cases is between eight percent and the statistical evaluation, which is consistent with an anchor at eight percent.

to expect. For example, the degree of reliance to be placed on the internal accounting control influences the level of the allowable risk of incorrect acceptance for the substantive test of details. If internal accounting controls are not to be relied upon, professional standards indicate that a reasonable level of risk is five percent [AICPA, 1981, paragraph 19]. Assuming that experienced auditors use this low level of allowable risk in the majority of situations, and that they would not test an account balance if they *expected* to reject it, an anchor on a low level of risk is possible. Based on the results of previous studies [Tversky and Kahneman, 1974; Kinney and Uecker, 1982] and on possible influences of professional standards [AICPA, 1981, paragraphs 12 and 19], the experiment will provide evidence on whether the risk assessments of experienced auditors are systematically biased due to anchoring on 50 percent risk, on the allowable risk of incorrectly accepting the account balance, or on an "internal" anchor when stating the achieved risk that the true monetary error for the population exceeds the tolerable error.[7]

METHOD

Subjects

There were two groups of subjects. The first contained 68 subjects recruited from 12 different offices of firms that ranged from local to Big Eight CPAs. These subjects had had at least two years of experience, with a mean level of about five years. They included seniors, managers, and partners. Auditors in this group performed both the substantive test of details task and the compliance test task.[8] The other 39 auditors were participants in training programs of one Big Eight firm, and they received only the test of details task. The average responses of the supplemental group could not be statistically distinguished from the "two task" group.[9]

Task

The task in this experiment was the assessment of risk when evaluating the sample results of accounts receivable confirmations. Since *SAS No. 39* [AICPA, 1981] suggests using just the direct risk assessment method, it was used in the experiment.[10]

Independent Variables

There was one independent variable manipulated between subjects. To test for an anchor on the allowable risk of incorrectly accepting the account balance, this risk was varied from .05 to .20 to .40. A control group was not given any information about the allowable risk. Because the allowable risk is not necessary to determine the achieved risk, it is normatively irrelevant.

Dependent Variable

The dependent variable was the subject's assessment of the achieved risk. Unlike the compliance sample setting, the statistical evaluation is not as straightforward in the substantive test of details setting. Since Kaplan [1973] found that incorrect inferences may be drawn when ratio and difference estimators were used on a population with few errors and when knowledge of actual audit populations is limited, a statistical evaluation was obtained from a multinomial Dollar Unit Sampling (DUS) program.[11] Given that auditors in this experiment were told to expect few errors, the multinomial DUS evaluation appears to be the best available statistical evaluation since it "is nonparametric in nature and known confidence levels are assured for all situations, no matter what the nature of the population, the nature of the error pattern, or the frequency of the errors" [Neter, Leitch, and Feinberg, 1978, p. 78], and is less biased toward incorrect rejection than is the Stringer bound.

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[7] The experiment was designed to address the use of the allowable risk and the internal anchor. A previous experiment was able to reject the 50 percent anchor in a compliance test task, and the results suggested the existence of an anchor below 50 percent. A summary of the experiment and the results is provided in the appendix.

[8] Booklets were constructed which contained instructions, a compliance test task, a substantive test of details task, and a post-experimental questionnaire. In half of the booklets, the compliance task was presented first, while in the other half the substantive test of details was presented first. A Kolmogorov-Smirnov two-sample test [Siegel, 1956] could not reject the null hypothesis of no order effects.

[9] The Kolmogorov-Smirnov two-sample test could not reject the null hypothesis of no difference.

[10] Other subjective probability elicitation methods may lead to different anchoring behavior, but because the professional guidelines recommend one method, only that method was used.

As in many accounting studies, determining the appropriate normative model which will define a "good" decision is very difficult [Joyce and Libby, 1981, p. 545], and any conclusions about anchoring behavior must be tempered by the conditional nature of this optimal model. Moreover, it was assumed that the auditors were making likelihood estimates like the model, and any information about the firm or population was reflected in the choice of the sample size and the allowable risk of incorrectly accepting the account balance. To the extent that they were engaged in a Bayesian analysis using contextual information to set a prior probability, both the model's likelihood estimate and the Bayesian auditor's posterior estimate may be correct. The statistical evaluation of the sample result using the multinomial bound algorithm led to an achieved risk assessment of 29 percent risk.

Background Information

Background information about the sample firm was provided in a paragraph that preceded the decision problem. Within the background information, two critical factors were incorporated. First, the average account balance was set at $290 with the maximum balance being $300. This combination was necessary since the (statistical) DUS criterion could not be used when a random sample of "physical units" with different book values or size is taken.[12] To evaluate a sample using DUS, the sample must be a randomly selected sample of all the dollar units rather than the physical units (i.e., individual accounts). However, since the range of account balances was limited, there was assumed to be little difference between a sample selected using the specific account as the sampling unit (as in judgmental sampling) and the one using a dollar as the sampling unit (as in DUS). Second, to make the sample sizes and the range of levels of allowable risk of incorrectly accepting the account balance seem reasonable, the subjects were told that these levels "have been determined after considering the reliance to be placed on the internal accounting controls and analytical review procedures."

Exhibit 1 presents the four conditions of the task used in the substantive test of details setting. The control group was not given the sentence stating the allowable risk, while the three treatment groups varied only on the level of the allowable risk given (e.g., five percent, 20 percent, or 40 percent).

Procedures

Subjects were randomly assigned to one of the four groups. For the 68 auditors who also did the compliance test task, the experiment was administered in two ways. For 36 of them, the experiment was given to a partner in the firm who ad-

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[11] The assessment was generated using the computer program described in Neter, Leitch and Feinberg [1978].

[12] Other methods that rely on a calculation of the standard deviation (see Roberts [1978] for examples) are not appropriate because a judgmental auditor would not necessarily calculate or use this information.

EXHIBIT 1

EXAMPLE OF THE SUBSTANTIVE TEST OF DETAILS TASK

You are auditing the accounts receivable balance of a retail firm. A sample of 100 of the 800 accounts has been selected for a confirmation of the recorded amounts. Since all of the accounts are small (average balance of $290; total book value of $232,000) and of limited range (the largest balance reported is $300), you have decided to use positive confirmations. From your experience with this client, you are expecting few errors, and your sample size and allowable risk have been determined after considering the reliance to be placed on the internal accounting controls and analytical review procedures. If you reject the account balance, alternative procedures will be used which may include extending the sample.

Sample size: 100 positive confirmations (selected out of the 800 accounts).
The book value of the sample is $29,000.
The following confirmations were in error:

Audited Value	*Book Value*	
$115	$295	$180
$200	$270	$ 70

$$250 \times \frac{800}{100} = \$2{,}000$$

The projected error (the best estimate of the monetary error in the population) based on this sample result would be *$2,000*. A tolerable error for the account balance is considered to be $3,800.

[The allowable risk of incorrectly accepting the account balance is set at 5 chances in one hundred (5%).]*

[The allowable risk of incorrectly accepting the account balance is set at 20 chances in one hundred (20%).]*

[The allowable risk of incorrectly accepting the account balance is set at 40 chances in one hundred (40%).]*

YOUR CHANCE ESTIMATE: Based on the sample result above, I believe that there is a ______% (between 100% and 0%) chance that the true monetary error for the population is *greater* than $3,800.

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* This sentence was included only in the appropriate treatment group.

ministered the experiment using instructions provided. The remaining 32 auditors completed the experiment at their offices under laboratory conditions supervised by the researcher.[13] For the additional 39 auditors, the experimental instrument was mailed to the training center where it was administered under laboratory conditions along with an unrelated audit judgment task.

RESULTS

The summary statistics for the groups are presented in Table 1. The results tend not to support a prediction of an anchor at 50 percent risk. In the control group, the mean is .263 and the median is .10 when the statistical evaluation is .29. Moreover, the means for the .05, .20, and .40 treatment groups lend support to the prediction that the anchor is the allowable risk (means of .115, .174, and .248, respectively). To be more precise, the allowable risk seems to have had an effect, but the results indicate another factor is influencing the assessment. The adjustment of the .05 group is in the correct direction toward .29, while the .20 group is in the wrong direction, and the .40 group has overadjusted. As discussed below, the

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[13] Based on a Kolmogorov-Smirnov two-sample test, there did not appear to be a difference in the distributions of responses due to the method of administration.

TABLE 1

SUMMARY STATISTICS FOR THE SUBSTANTIVE TEST OF DETAILS EXPERIMENT—AUDITORS

Group	*n*	*Mean*	*Variance*	*Standard Deviation*	*Median*
Control*	27	.263	.085	.291	.10
.05**	27	.115	.011	.106	.08
.20**	27	.174	.036	.190	.15
.40**	26	.248	.050	.224	.16

* Statistical evaluation for all groups is .29.

** Values of the stated allowable risk in the group.

anchor may be an internal anchor with the allowable risks influencing the adjustments.

It may be that auditors are not biased when the allowable risk is not presented. In order to test this proposition, a *t* test of the null hypothesis that the population mean for the control group equals the statistical evaluation of .29 yields a test statistic of $-.47473$ ($n=27$). This is an insignificant difference ($p=.64$) between the sample mean of .263 and .29. This lack of an anchor on 50 percent risk is further supported when the individual risk assessments are classified by location. In Table 2, the 27 risk assessments of the control group were classified as being below the statistical evaluation of .29, between .29 and .50, and above .50. If 50 percent is the anchor, all of the risk assessments should be in the middle cell. Since only two of the risk assessments are in that cell, it seems clear that the anchor is not 50 percent.

A second possible anchor is the allowable risk. Moreover, there is the possibility that an anchor is not a monotone increasing function. From an examination of Table 1, both the means and the medians suggest that the knowledge of the allowable risk has an effect and it is a monotone increasing function of .05, .20, and .40. The Jonckheere distribution-free test [Hollander and Wolfe, 1973, p. 120] is able to test for a specific ordered alternative. A null hypothesis of no order among the average ranks (τ) is tested against an ordered alternative hypothesis where at least one of the inequalities is strict.

$$H_0{:}\ \tau_{.05}=\tau_{.20}=\tau_{.40}$$

$$H_1{:}\ \tau_{.05}\leq\tau_{.20}\leq\tau_{.40}$$

The null hypothesis may be rejected: $J=1343.5, p<.01$.

The results are consistent with the hypothesis that the knowledge of the level of allowable risk caused a systematic bias in the auditors' assessments of risk. Furthermore, the order of the responses is a monotone increasing function of the order of the allowable risks.

A closer examination of both the means and medians in Table 1 suggests that although the *stated* allowable risk had an influence on the risk assessments, it may not have been the primary influence. A possible alternative explanation of the results is that the experienced auditors come into a task like the one used with an internal anchor. To see how this internal anchor would operate, consider the mean or median responses in Table 1. If the stated allowable risks are the starting points and the insufficient adjustment follows, the average response for the .40 group should be between .40 and the statistical evaluation of .29 rather than the *overadjustment* down to .248. Similarly, the average response for the .20 group should be up

TABLE 2

LOCATION OF THE RISK ASSESSMENTS BY THE CONTROL GROUP—AUDITORS

	$X \leq .29$	$.29 < X \leq .50$	$.50 < X$
Control group	19	2	6

toward .29 rather than down to .174. The .05 group is consistent with either an internal anchor on a low level of risk or the stated allowable risk of .05.

The result from the auditors is consistent with the use of an internal anchor, but since this anchor is the result of experience, it is not possible to manipulate the anchor using experienced auditors. If the anchor is a function of experience, student subjects who have not been exposed to any auditing should not be biased in the same manner as the auditors. In order to test this difference based on experience, undergraduate students who had not taken an auditing class and were not familiar with *SAS No. 39* [AICPA, 1981] were asked to assess the risk in the test of details task. Care was taken to make sure that they understood the task without making any reference to the between-subject manipulation. They were randomly assigned to one of the four experimental groups. If there is an internal anchor present in the experienced auditors and not in the students, the students are more likely to focus primarily on the stated allowable risk.

The student subjects completed the task in class without a time constraint. Summary statistics for the four groups are presented in Table 3.

Unlike the auditors, the students seem to be anchoring on the stated allowable risks of .05, .20, or .40 (and .50 for the control group) and then adjusting toward the statistical evaluation of the sample (.29). In particular, the median responses for the .20 and .40 groups fall in the .20–.29 and .29–.40 ranges, respectively, as predicted by an allowable risk anchor. On the other hand, the auditors in the .20 group were below .20 and in the .40 group were below .29. As expected, the students do not appear to have an internal anchor.

Three sets of tests were conducted to determine whether the auditors' responses were stochastically lower than those of the students, indicating the existence of an internal anchor. The first Mann-Whitney U test made no distinction among the control group and the treatment groups. All 107 assessments of the auditors were compared to the 58 student assessments. A one-tailed test indicates that the auditors' assessments are lower than those of the students ($U = 2266$, $p = .002$). Next, a Mann-Whitney U test was conducted for each of the levels of allowable risk. The alternative hypothesis that the auditors' assessments are below the students' assessments is generally supported. For the .05, .20, and .40 groups, the null hypothesis can be rejected at the 0.42, .12, and .067 levels, respectively. Perhaps the strongest test of the internal anchor hypothesis is where there are no influences other than the differences in the two groups. A comparison of the control group of auditors with the control group of students lends support to the hypothesis that the auditors have generally lower risk assessments ($U = 128.5$, $p = .0477$).

DISCUSSION

The results of the experiments reported

TABLE 3
SUMMARY STATISTICS OF STUDENT SUBJECTS

Group	*n*	*Mean*	*Standard Deviation*	*Median*
Control*	14	.379	.301	.25
.05**	15	.173	.132	.10
.20**	15	.286	.256	.20
.40**	14	.359	.229	.35

* The statistical evaluation is .29.
** Stated allowable risk levels.

in this paper indicate that there is a form of anchoring behavior in the judgmental evaluation of audit samples. It is not, however, the behavior necessarily predicted by Tversky and Kahneman [1974] or Kinney and Uecker [1982]. Specifically, rather than finding 50 percent or a value stated in the problem to be the anchor, it appears that experienced auditors make assessments of risk by starting at a low level of risk of .05 or .10. This internal anchor may be the result of evaluating a number of samples that have low risk, with the result that the auditors tend to expect low risk in samples to such an extent that the sample result does not have much impact. By having a bias toward low risk assessments, the auditor may be unconsciously increasing the risk of incorrectly accepting an account banance.

In the substantive test of details task, where an explicit allowable risk of incorrectly accepting the account balance was given, it appears as though the allowable risk does bias the risk assessment. It is as though the risk assessments are a function of anchoring on the internal anchor with an adjustment for the allowable risk and the sample result. Results using student subjects tend to support the concept of an internal anchor for the auditors and an allowable risk anchor for the students.

There are two primary limitations in the experiments. First, as is usual in audit judgment research, the subjects are not a true random sample of all auditors since they are chosen by the firm to be participants. They are, however, randomly assigned to treatments. Second, for a large number of subjects there is no control over the administration of the task because it was mailed to them. There does not appear to be any measurable difference between the responses of this group and the group that performed the task under laboratory conditions.

Future research might investigate further the existence of an internal anchor in the judgmental evaluation of audit samples. A study could make a more systematic comparison between expert and novice auditors. The purpose of such a study would be to determine more precisely if an internal anchor exists, and if the adjustment process depends upon factors such as the allowable risk, tolerable error, and the sample result. This line of research may lead to (1) extending and refining the prediction of when and how the anchoring and adjustment heuristic would be used, and to (2) the development of effective decision aids.

APPENDIX

The purpose of this appendix is to give a brief description of the compliance test experiment. The primary purpose of the experiment was to test the 50 percent risk

EXHIBIT 2
EXAMPLES OF THE COMPLIANCE TEST TASK

Assume that you are working on the audit of a small company. During an interim examination you are checking purchase invoices for the presence of a "received" stamp for the goods ordered. The omission of the stamp is considered a "compliance deviation." The population is composed of the approximately 4,000 invoices which were processed by the client during the current year.

[You decide that a deviation rate as high as 8% would not require any extended audit procedures. However, if the population deviation rate is greater than 8% you would want to extend the procedures.

Based on the sample result below, estimate the chance (between 100% and 0%) that the true population deviation rate is *greater* than 8%.

A sample of 40 invoices with 3 deviations—a sample deviation rate of 7.5%.

YOUR CHANCE ESTIMATE: Based upon a sample of 40 invoices with 3 deviations, I believe there is a _____ (between 100% and 0%) chance that the true population deviation rate is greater than 8%.]*

[You decide that a deviation rate as high as 5% would not require any extended audit procedures. However, if the population deviation rate is *greater* than 5% you would want to extend the procedures.

Based on the sample result below, estimate the chance (between 100% and 0%) that the true population deviation rate is *greater* than 5%.

A sample of 60 invoices with 2 deviations—a sample deviation rate of 3.3%.

YOUR CHANCE ESTIMATE: Based upon a sample of 60 invoices with 2 deviations, I believe that there is a _____ (between 100% and 0%) chance that the true population deviation rate is *greater* than 5%.]*

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* The two sections in brackets represent the two experimental conditions.

or even odds anchor that had been suggested by Kinney and Uecker [1982]. The key difference between the present experiment and Kinney and Uecker's is that all of the statistical evaluations in their study were below 50 percent risk, while in this case the statistical evaluations are both above and below 50 percent.

Method

Subjects. The 68 subjects were auditors from 12 different offices of firms ranging from local to Big Eight CPAs. The average experience was about five years.

Task. The task required an evaluation of a compliance sample result. It was the same task used by Kinney and Uecker [1982] (see Exhibit 2 for examples of the task).

To achieve a risk above 50 percent, the difference between the tolerable error rate and the sample error rate was 0.5 percent (eight percent minus 7.5 percent) based on a sample of 40 invoices with three errors. This yielded a statistical evaluation of achieved risk of .60. For an achieved risk approximately the same amount of adjustment below 50 percent, the difference between the tolerable error and the sample error rate was 1.7 percent (five percent minus 3.3 percent) based on a sample of 60 invoices with two errors. The statistical evaluation is .42.

Results and Discussion

The results do not support the prediction of an anchor at even odds. When the statistical evaluation of the sample is .60, if the anchor is .50, the average response resulting from an insufficient adjustment should be in the range between .50 and .60. In fact, the mean and median responses are .410 and .375, respectively. Similarly, when the statistical evaluation is

.42, an insufficient adjustment should result in an average response in the range between .50 and .42. The mean and median responses are .201 and .10, respectively.

An alternative method to test for an even odds anchor is to classify the data by their location relative to the statistical evaluation and .50. For example, when the statistical evaluation is .60, 19 risk assessments are below .50, six are between .50 and .60, and nine are greater than or equal to .60. Twenty-eight of the 34 risk assessments cannot be explained by an even odds anchor. The same is true for the assessments made when the statistical evaluation is .42. There are 29 risk assessments less than or equal to .42, and three above .50. Only two responses were in the predicted range between .42 and .50. The evidence leads to a strong rejection of the prediction of an even odds anchor.

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A Note on Participation in Budgeting and Locus of Control

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ABSTRACT: The impact of personality variables on participative management systems has been a subject of considerable current interest to researchers. The effect of locus of control on the relationship between participation and performance of subordinates in a participative budgeting environment was recently examined by Brownell. This study examines the participative relationship between superiors and subordinates. The findings of a laboratory experiment indicate that locus of control also may influence the behavior of superiors involved in the participative budgeting process in accepting the inputs of their subordinates. The results of this experiment support the hypothesis that internal managers are willing to allow subordinates greater participation than are external managers.

Locus of control is a personality variable which classifies individuals as internals or externals depending on the extent that they feel they exercise control over the reinforcements that occur relative to their behavior [Phares, 1968]. Internals are those individuals who feel that their rewards or punishments are determined by their own actions; externals are individuals who feel that the force that yields the rewards or punishments is beyond their control.[1]

The moderating effect of the locus of control personality variable on the relationship between participative budgeting and the performance of subordinates has been examined by Brownell [1981; 1982b]. The objective of this paper is to report the findings of a laboratory experiment which indicate that locus of control also may influence the behavior of superiors involved in the participative budgeting process.

LITERATURE REVIEW

Participation involves the face-to-face interaction of two individuals, a superior and a subordinate, for the purpose of establishing a budget that is acceptable to both parties. The benefits of budgetary participation have been found in terms of job satisfaction [French, Kay and Meyer, 1966; Cherrington and Cherrington, 1973], attitudes toward both the job [Milani, 1975] and the budgetary system [Collins,

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[1] Locus of control has been shown to be related to such factors as performance [e.g., Majumber, MacDonald and Greever, 1977], achievement [e.g., Rotter and Mulry, 1965], information-seeking ability [e.g., Davis and Phares, 1967], and attitudes toward businesses [e.g., Joseph and Cook, 1981]. For a comprehensive review of the research findings involving locus of control, see Spector [1982].

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1978], motivation [Hofstede, 1967], and morale [French, Kay and Meyer, 1966]. However, the relationship between budgetary participation and performance is not as well established in the research literature. (See Brownell [1982a] for a review of the literature and a discussion of the conditional factors which may affect this relationship.) Some findings suggest a positive effect on performance [Argyris, 1952; Becker and Green, 1962; Bass and Leavitt, 1963; Kenis, 1979; and Brownell, 1982c], while others suggest either no effect or negative effects [Milani, 1975; Morse and Reimer, 1956; Bryan and Locke, 1967; and Stedry, 1960].

The effectiveness of budgetary participation depends on the manner in which both the superior and the subordinate act in and react to the participation process. Brownell [1981, 1982b] examined the subordinate's reaction to participation as a function of the subordinate's locus of control and found that this personality variable may have a moderating impact on the participation-performance link. Brownell [1981] measured participation as an independent variable by manipulating it at high and low levels.

It is conceivable that a supervisor involved in budget preparation may have a choice as to the amount of influence that he will allow the subordinate to have on his determination of the budget and, further, that locus of control may affect the superior's behavior in the participation process in terms of biasing either toward or away from the subordinate's performance expectation. Therefore, the present study measures budgetary participation as a dependent variable, or one which the supervisor controls.

Phares [1976] noted distinct differences in behavior patterns between internals and externals. Internals (1) put forth a greater effort to control their environment; (2) demonstrate superior learning; and (3) seem to be more adept with information. These differences in behavior appear to be important determinants of organizational behavior, since locus of control has been found to relate to a wide variety of factors relevant to employee behavior in an organizational setting. These factors include motivation, effort, performance, satisfaction, perception of the job, and compliance with authority (see Spector [1982] for a comprehensive review of this literature).

A link between a manager's locus of control and his preference for supervisory style was suggested by the findings, taken in combination, of Holden [1958], Simmons [1959], and Seiler and Bartlett [1982] and was supported by Goodstadt and Hjelle [1973]. Holden [1958] and Simmons [1959] found an association between the personality variable locus of control and authoritarianism in that externals tend to be authoritarian persons, while Seiler and Bartlett [1982] found that authoritarian persons (managers) prefer budgetary systems which are more rigid and which exhibit lower levels of participation. The implication by extension from the common association with authoritarianism is that externals will tend to have greater preferences for a less participative style of management. Goodstadt and Hjelle [1973] examined this link directly in a laboratory setting and found that externals used a more coercive style of supervision, whereas internals used a more personal, persuasive style of supervision.

HYPOTHESIS

The findings discussed above provide a basis for forming expectations concerning the behavior of internals and externals as superiors in a participative process. Externals, who have a more authoritative leaning, may tend to subvert the partici-process by not fully accepting a subordinate's input. In contrast, internals, who tend to use a friendly persuasion approach and who themselves prefer a more participative style, seem most likely to accept the participative budgeting format and to encourage participation. These expectations are formalized as follows:

Research Hypothesis: An internal manager allows greater subordinate participation than an external manager.

EXPERIMENTAL METHOD

Subjects

The Rotter [1966] Internal-External Scoring instrument[2] was administered to 127 undergraduate accounting students enrolled at a major private university located in the east. The locus of control (LOC) scores were normally distributed, ranging from one to 20 (s.d. of 3.57) with a mean of 11.34 and a median of 11. Twenty volunteers were selected randomly from both the lower one-third (LOC less than ten, indicating internals) and upper one-third (LOC more than 13, indicating externals) of the LOC scores to form a group of internal subjects and a group of external subjects. The subjects were paid $5.00 for their participation.

Task

The experiment involved both a supervisor and a subordinate interacting in a participative budget setting. The participants in the experiment assumed the role of a supervisor; the subordinate was played by an actress.[3] The task of the subordinate supposedly was to complete a set of 40 angle-matches in a 15-minute time period.[4] The subordinate's performance was to be measured by the number of correct matches made in the allotted time. The supervisor was to be compensated by a payment of 20 cents for every correct angle-match decision made by the subordinate.[5] The purpose of a participative budgeting meeting is to establish a performance budget which will maximize the superior's utility. This maximization is assumed to occur by maximizing the subordinate's performance and, as a consequence, the payment to the supervisor. The subject-supervisor's task was to establish a budgeted performance goal for the subordinate before a participative budget meeting and again after the participative budget meeting with the subordinate. The superior strives for a budget that achieves a balance between dysfunctional performance induced by a budget that is too difficult to attain and insufficient subordinate motivation if the budget is easily attained.

Compensation for the subordinate is often tied to the budget such that the subordinate is motivated to provide an expectation that is biased toward the low side. To experimentally provide a parallel situation to the subjects, the following compensation plan for the subordinate was described to the subject-supervisor:

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[2] The internal-external scale questionnaire, developed by Rotter [1966], contains 23 questions and six filler questions which require a forced response between an "internal" and "external" answer. A participant's response set is scored by summing the total number of external responses; the higher the score, the less internal and more external is the participant's relative orientation. Hersch and Scheibe [1967], in summarizing the previous work by Rotter [1966] and Lefcourt [1966], concluded that the test-retest reliability of the Rotter scale is between .49 and .83 for various samples and intervening time periods. The split-half reliability found for the participants in the present study was .72. The Rotter questionnaire also was used by Brownell [1981, 1982b] in the study of subordinate behavior in a participative budget setting.

[3] The actress was a 21-year-old accounting major with acting experience. She received extensive training (including a pilot test) prior to the experiment and was compensated for her time at an agreed-upon hourly rate. In a post-experimental follow-up during the pilot test, none of the participants indicated that they realized that the role of the subordinate was being played by an actress.

[4] The angle-matching task is similar to that used by Gregory [1978]. A set of 40 angle-matches was used because it could be completed in approximately 15 minutes and a budgeted performance could be established prior to the actual performance of the task (see Gregory [1978, p. 842]).

[5] All subjects were paid the same amount. The payment was made at the conclusion of the entire experiment so that no subject could learn that the compensation plan was moot.

> $5.00 if the subordinate's performance equaled or exceeded the budget;
> $4.00 if the performance was 1–5 matches below budget;
> $3.00 if the performance was 6–10 matches below budget;
> $2.00 if the performance was 11–15 matches below budget; and
> $1.00 if the performance was 16-20 matches below budget.

No compensation was paid if the performance was 20 matches (or more) below budget.

This step-wise plan varies directly with performance and is tied to the budget goal established by the supervisor.

Procedures

In an initial meeting, the subordinate-actor and the supervisor-participant met for the first time. They were told that both were randomly selected, and they were not allowed to converse with one another at this time. The subordinate-actor then left the room, on the premise that further, separate instructions were forthcoming.

Each supervisor-participant was given: (1) a description of the subordinate's task; (2) two sample tasks containing an easy and a difficult angle-match; (3) the set of 40 angle-matches that the subordinate will perform; and (4) the compensation plan for both the supervisor and the subordinate. The subject-supervisor then provided an estimate of the number of matches that the subordinate would correctly identify within the 15-minute period. This estimate is referred to as the initial performance estimate (IPE).

Next, the superior and the subordinate met for approximately three minutes, at which time the subordinate-actor provided the supervisor-participant with an expected performance budget (EPB). This value was calculated identically for all participants as the supervisor's IPE minus 11.[6] To the extent practical, the subordinate followed an identical script in presenting the performance expectation to all participants.

After the subordinate departed, the supervisor provided a performance goal for the subordinate. This goal is referred to as the post-participation goal (PPG). Participation was measured by the subject's change in performance estimate, that is, it is a difference measure calculated as the change in response from IPE to PPG.[7] The participation measure (PM) represents the degree of influence on the budget that a subordinate is allowed by the supervisor, and represents a measure of participation similar to the measure used by Brownell [1981].

RESULTS AND CONCLUSIONS

The mean of the PM variable differed significantly (student $t=3.26$, $p=.01$) at 6.75 and 5.20 for the internal and external groups, respectively, suggesting that internals tended to allow greater participation and thereby supporting the research hypothesis.[8]

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[6] The value of approximately ten was selected based on the experimenters' judgment that this level would appear reasonable to the subjects and yet be sufficiently large to capture any impact that LOC might have on their decision. Eleven was chosen to avoid the appearance of being a contrived number which might assist the subject to see through the experiment. Post-experiment interviews with the subjects in the pilot test indicated that this value was reasonable.

[7] The relationship between IPE and LOC was also examined. No statistical significance was detected. The range of PM scores was from zero to ten (mean of 5.98, s.d. of 2.37). The conceptually sensible measure for PM is PPG-EPB (the difference between the final budget determination of the superior and the subordinate's suggestion). However, PPG-IPE is a perfect proxy since IPE is a linear transformation of EPB.

[8] Because the difference in variance between internal and external groups was not significant ($F=1.20$), a pooled variance was used for the statistical test. As a part

The findings of this experiment indicate that the personality variable, locus of control, may have a relationship with the extent to which a superior is willing to accept the input of subordinates in the participation process. This study represents an initial step in understanding the impact of locus of control on a superior's behavior in the participative budgeting process. Additional research should focus on the extent and the nature of face-to-face interactions, along with measures of resulting conflict, that result between a superior and subordinate in an actual participative budget meeting.

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of this experiment, supervisor participants were presented with a score of the accuracy of the subordinates' decisions, manipulated at two levels; either a high score calculated at 125 percent of PPG or a low score set at 75 percent of PPG. The subjects rated the subordinates' scores on a seven-point scale with polar values indicating poor to excellent performance. No statistical significance was noted between this rating and either LOC or PM.

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A Note on a Comparison of Bayesian with Non-Bayesian Dollar-Unit Sampling Bounds for Overstatement Errors of Accounting Populations

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ABSTRACT: There has been a proliferation of dollar-unit sampling bounds over the past few years; however, in many cases there has been little guidance provided on the relative performances of these bounds under representative audit conditions. This is particularly true of the Bayesian bounds which are analyzed here. One purpose of this study, therefore, is to provide further validation of Bayesian models by assessing their robustness when using diffuse priors on the "typical tainting patterns" of Leitch, et al. [1982]. A second purpose of the study is to compare Bayesian bounds with non-Bayesian bounds. The study found that even with diffuse priors, some Bayesian models show potential for improving on the performance of non-Bayesian dollar-unit sampling techniques.

This note extends previous research in dollar-unit sampling (DUS) by evaluating the comparative performance of Bayesian and non-Bayesian DUS procedures using an approach pioneered by Leitch, et al. [1982]. Under this approach two methods of study are used. One method is to use "typical tainting patterns [to create] in a single sample of given size a faithful replica of a particular population tainting distribution for a specified error rate. This single sample is then evaluated by calculating both kinds of bounds . . . for this tainting distribution, given the sample size and error rate" [Leitch, et al., 1982, p. 390]. An advantage of this method is that it can be used to provide concise information on the relative tightness of various DUS bounds for tainting patterns which are commonly found in audit situations [Leitch, et al., 1982, p. 389]. A second method of study under the Leitch, et al. approach, however, is required to complement the results on the typical tainting patterns. This is the method of computerized sampling simulation.

There are two reasons for the computer simulation. The first is to confirm that use of the typical tainting patterns is a reasonable surrogate for the relative measure of the tightness of the bounds on av-

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erage. The second is to measure the relationship between the stated confidence level and the realized confidence level associated with the bounds. By combining the bounds analysis with the assessments of the realized confidence level, the relative effectiveness as well as efficiency of the bounds can be assessed. Effectiveness and conservatism relate to bounds whose realized confidence levels are greater than or equal to the planned confidence level, say 95 percent. Efficiency relates to the tightness or relative magnitude of the bound. The generalizability of the results is limited by the representativeness of the audit conditions considered here, the typical tainting patterns of Leitch, et al. [1982].

Godfrey and Neter [1984] and Menzefricke and Smieliauskas [1984] analyze exponential and normal distribution-based Bayesian models. This paper provides additional validation evidence for these Bayesian bounds by (a) considering the typical tainting patterns of Leitch, et al., and (b) using diffuse or almost diffuse priors in the analysis. For the convenience of the reader, the reported results for the non-Bayesian bounds from Leitch, et al. [1982], Neter, Leitch and Feinberg [1978], and Dworin and Grimlund [1984] are also included.

A Bayesian bound is one which allows the auditor to formally incorporate non-sample as well as sample information in the bound calculation. This paper uses diffuse or almost diffuse priors so that it is possible to identify the adequacy of the Bayesian models in terms of sample information alone. Use of diffuse prior information means that the effect of prior information is negligible in comparison to information from the sample.

Some readers may wonder why models that follow a Bayesian philosophy of incorporating sample and non-sample information should be analyzed with diffuse priors. There are several reasons for this, as pointed out by Winkler and Hays [1975, pp. 523–525]. First, it may be useful to remove the effect of the statistician's own prior judgments as much as possible. Such an approach "enables others to include their own prior judgments and to proceed accordingly" [Winkler and Hays, 1975, p. 524]. Second, use of a diffuse prior distribution may be considered to provide a better comparison with classical statistical procedures because both procedures are then essentially based on the same set of information. Third, Winkler and Hays [1975, p. 525] suggest that use of a diffuse prior distribution acts as a useful starting point for investigating the influence of non-sample information in the results. All of these reasons suggest that for scientific reporting purposes, it is useful to present the results that follow from using a diffuse prior distribution.

Some readers also may wonder why long-run frequency performance in the classical sense is a relevant measure of Bayesian-based performance. Long-run frequencies can be used to develop measures of the achieved characteristics of Bayesian bounds over a variety of audit conditions. These measures then can be readily compared to the non-Bayesian bounds.

Several of the bounds require *ad hoc* adjustments when there are both over- and understatement errors and the auditor wishes to compute a bound on the total net error. However, the typical tainting patterns of Leitch, et al., consist of overstatement taintings only, and thus it is possible to identify which bounds perform best where there is no need to make *ad hoc* adjustments for any of them.[1]

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[1] These results also apply to understatement only error patterns (e.g., see Neter, Leitch and Feinberg [1978, pp. 87–88]). Understatement error patterns tend to have the *J* and unimodal type error distributions and only the sign of the bound is changed.

TABLE 1

SUMMARY OF DUS BOUND COMPUTATIONS

Definitions:

n = sample size
k = number of errors found in a sample of size n
BV_i = book value of account item i
AV_i = audit value of account item i

$$t_i=\frac{BV_i-AV_i}{BV_i}$$

$$\bar{t}=\frac{1}{k}\sum_{i=1}^{k} t_i$$

$$v=\frac{1}{k}\sum_{i=1}^{k}(t_i-\bar{t})^2$$

R_k = Poisson reliability factor for the specified confidence level and k errors (i.e., R_k is the mean for the Poisson random variable X such that for confidence level $= 1-\beta$, and number of sample errors k, $P(X\leq k)=\beta$)
N = number of account items in the population

$$Y=\text{population book value}=\sum_{i=1}^{N} BV_i=\$1{,}000{,}000$$

μ = expected value of the tainting distribution for non-zero taintings
σ^2 = variance of the tainting distribution for non-zero taintings
π = proportion of dollar units having non-zero taintings
m_0 = prior value assessed for μ
v_0 = prior value assessed for σ^2
p_0 = prior value assessed for π
r_0 = prior "equivalent" sample size attached to m_0
ν_0 = prior "equivalent" sample size attached to v_0
n_0 = prior "equivalent" sample size attached to p_0

1. SB = Stringer bound:

$$SB=\frac{1}{n}\left(R_0+\sum_{j=1}^{k}(R_j-R_{j-1})t_j\right)\cdot Y$$

where t_j are ranked so that $t_1\geq t_2\geq \ldots \geq t_k$.

2. $GOLOS$ = Greater of load or spread bound:
Uses an iterative procedure requiring k iterations,

$$UEL_0=\frac{1}{n}(R_0)$$

$$UEL_i=max\left(UEL_{i-1}+\frac{t_i}{n},\frac{R_i t_i}{n}\right)\text{ for } i\geq 1$$

$$GOLOS=UEL_k\cdot Y$$

where t_j are ranked so that $t_1\geq t_2\geq \ldots \geq t_k$.

3. CS = Cox and Snell bound:

$$CS=\frac{(k\bar{t}+(r_0-1)m_0)}{k+r_0}\,\frac{(k+n_0p_0)F}{n+n_0}\cdot Y$$

The major finding of the study is that some Bayesian DUS bounds can be used to improve on the performance of non-Bayesian DUS procedures even when the priors are diffuse. This is an important step in the practical validation of the Bayesian models because it increases the attractiveness of Bayesian models for auditors. Auditors can use Bayesian models even when they have little prior information because the models may still result in efficient and effective test procedures.

TABLE 1—CONTINUED

where F is a random variable with the standard F distribution with $2(k+n_0P_0)$ and $2(k+r_0)$ degrees of freedom.

4. $N2$ Bound:

$$N2=\left[\frac{m_1k_1}{n_1}+{}_{\nu_1}t_{.95}(VAR)^{1/2}\right]Y$$

where

$$VAR=\left[m_1^2\frac{k_1(n_1-k_1)}{n_1^2(n_1+1)}+\frac{v_1\nu_1}{\nu_1-2}\,\frac{k_1+1}{n_1}\,\frac{k_1}{r_1(n_1+1)}\right]\frac{\nu_1-2}{\nu_1}$$

$m_1=(r_0m_0+k\bar{t}/r_1$

$r_1=r_0+k$

$\nu_1=S(r_0)+\nu_0+k-1$

$S(r_0)=1$ if $r_0=0$ and $S(r_0)=0$ if $r_0=0$

$$\nu_1v_1=\frac{r_0k}{r_1}(m_0-\bar{t})^2+kv+\nu_0v_0$$

$k_1=n_0p_0+k$

$n_1=n_0+n$

${}_{\nu_1}t_{.95}$ is the 95th percentile of a student $-t$ distribution with ν_1 degrees of freedom.

Examples of situations in which diffuse priors may have inherent interests for auditors include: (1) first-time audit engagements and (2) rapidly changing environments in which prior experience may be an unreliable guide as to the characteristics of the current environment (e.g., a rapidly growing firm or one in which computer processing has been introduced).

DISCUSSION OF DUS BOUNDS

The bounds covered here can be separated into two general classes: Bayesian and non-Bayesian. The non-Bayesian bounds are the Stringer bound (SB), the multinomial bound (MB), the greater of load or spread (GOLOS) bound, and the Dworin and Grimlund (DG) bound. Neter, Leitch and Feinberg [1978] and Leitch, et al. [1982] have already analyzed SB and MB. The GOLOS and DG bounds have already been analyzed in Dworin and Grimlund [1984]. Here I compare their reported results with those of the Bayesian bounds. I also analyze separately the SB and GOLOS bounds. The SB, GOLOS, and Bayesian bounds are defined in Table 1.

It is well-known that the widely used SB of audit practice is conservative (see Felix and Kinney [1982, p. 264]). The SB represents a convenient benchmark to use as a comparison to other bounds. The other non-Bayesian bounds listed above represent different attempts to improve on the SB. This involves developing a smaller upper error bound for which the realized confidence levels equal or approximate the planned confidence level. An implicit assumption in comparing the bounds is that they meet the same confidence level requirement, e.g., a 95 percent confidence level. A bound can be considered an improvement only if it is lower than SB *and* meets the specified confidence level requirement.

The Bayesian bounds considered here are the CS bound, based on the Cox and Snell [1979] model, and the N2 bound, based on the Felix and Grimlund [1977] model. Godfrey and Neter [1984] analyze the CS bound when there are overstatement errors only and where there is moderate to strong prior knowledge. Menzefricke and Smieliauskas [1984] analyze the CS bound and the N2 bound. However, their analysis addresses the problem of combining over- and understatement

TABLE 2

PRIOR PARAMETER VALUES

Model Parameter	*Prior Parameter*	*Diffuse Prior for CS*	*Diffuse Prior for N2*
μ	m_0	—**	—
	r_0	1	0
σ^2	ν_0*	N.A.	.33
	ν_0*	N.A.	2
π	p_0	—	—
	n_0	0	0

* Is applicable to the *N*2 bound.
** Entries marked "—" are arbitrary.
N.A. = not applicable.

errors in computing bounds on net error using DUS. An attractive feature of the N2 model is that no *ad hoc* adjustment has to be made for understatement errors to compute a net bound on total error.

Perhaps the most important criticism that can be directed at the N2 model concerns the assumption that the density of non-zero dollar taintings is normal.[2] There is no empirical evidence to indicate that taintings or errors are normally distributed (e.g., see Johnson, Leitch and Neter [1981] and Leitch, et al. [1982]). However, this empirical evidence also indicates that no single assumption about the shape of the tainting distributions will be appropriate to all audit situations. These results, therefore, suggest the desirability of using techniques that are robust with respect to the tainting distribution, including whether or not significant spikes occur at the 100 percent tainting level. (The term "robust" here is used to describe bounds whose achieved confidence levels are "close" to nominal [planned] levels for a wide range of populations.) This reliance on the robustness of the estimator is thus the primary justification for the N2 bound. The presumption is that on average, over a variety of tainting patterns, this bound will perform at least as well as "more realistic" but possibly less robust models.[3] This paper presents empirical evidence on the robustness of the performance of the N2 model with diffuse priors for the typical tainting conditions of Leitch, et al.

Table 2 gives the prior values for the Bayesian bounds used in this paper. Columns 3 and 4 give the diffuse priors for the CS and N2 bounds, respectively. Diffuseness is defined relative to its impact on sample information. Diffuse prior information may be such that it is "overwhelmed" by sample information so that the posterior distribution is not affected by the prior distribution [Winkler, 1972, p. 270]. Using this concept of diffuseness, the prior values for r_0 and n_0 in column 3 of Table 2 have been set so that the posterior values m_1 and p_1 are not affected by the prior values m_0 and p_0, for μ and π, respectively, in the CS bound.

Column 4 of Table 2 is obtained by applying the same logic to the N2 bound. This means, however, that the additional

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[2] The full theoretical development of the model is provided in Menzefricke and Smieliauskas [1984]. The model is a modification of the general model developed in Felix and Grimlund [1977] and Grimlund [1982].

[3] Winkler and Hays [1975, p. 525] indicate, moreover, that selection of statistical models is "ultimately subjective."

TABLE 3
COMPARISON OF BOUNDS
(BOOK VALUE = $1,000,000, 95 PERCENT CONFIDENCE LEVEL, SAMPLE SIZE = 101)
BOUNDS IN THOUSANDS

	Stringer Bound	*Multinomial Bound**	*GOLOS*	*CS*	*N2*	*DG***
One Error						
1	29.83	29.20	29.76	.34	23.47	26.60
25	33.99	29.60	32.14	8.59	25.85	15.44
50	38.31	31.10	34.61	17.19	28.32	22.57
75	42.64	35.40	37.10	25.78	30.80	30.39
99	46.80	45.60	46.50	34.03	33.17	38.05
Two Errors						
1,95	46.26	43.80	44.72	28.73	35.45	35.1
25,75	46.49	35.80	39.56	29.93	32.48	33.44
50,50	46.00	35.40	39.56	29.93	30.94	32.25
75,90	56.77	48.20	49.70	49.38	40.83	49.16
100,100	62.34	61.00	62.33	59.85	46.37	58.23
Four Errors						
1,2,3,4	31.24	29.30	30.65	2.43	17.14	26.77
1,40,60,99	61.93	50.30	56.50	48.66	45.96	51.99
1,1,50,50	46.28	35.44	39.76	24.82	30.44	31.02
10,20,30,40	45.47	32.57	39.56	24.33	28.25	28.68
25,40,60,75	61.10	42.90	49.46	48.66	43.13	49.74
50,50,50,50	60.15	46.00	49.46	48.66	41.88	48.74
96,97,98,99	89.17	85.00	87.00	94.89	72.14	89.30
Six Errors						
50,50,50,50,50,50	73.46	57.40	59.36	65.52	53.81	63.45

* These results were obtained from Table 4 in Neter, Leitch, and Feinberg [1978].
** These results were obtained from Table 2 in Dworin and Grimlund [1984].

parameter of the N2 bound, ν_0, may need to be assigned a value with a non-zero prior weight (equivalent sample size) of ν_0. The prior value ν_0 chosen, therefore, is a rather conservative value relative to the typical tainting patterns of Leitch, et al. [1982] and $\nu_0=2$ is the minimum value required to make the N2 bound operational for all sampling conditions considered here.[4] As a result, the prior value assigned to ν_0 does have some influence on the N2 results reported in the tables. Some limited sensitivity analysis suggests, however, that the results for the simulations are somewhat insensitive to moderate changes in ν_0.

EMPIRICAL RESULTS OF THE STUDY

The models specified in Table 1 were used to compute bounds on the total overstatement error for the tainting patterns described in Leitch, et al. [1982, p. 389–390], i.e., the J, $J-100$, unimodal, and

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[4] Due to the nature of the approximations used in developing the N2 bound, the bound can only be computed when total sample sizes r_0+k, ν_0+k, and n_0+n exceed minimum values. One such combination is that given in Table 2 for N2. Perhaps the best way to think of this limitation is that when a pure diffuse prior is used (i.e., $r_0=\nu_0=n_0=0$), then the auditor has no prior knowledge. If this is combined with a sample result which provides no additional information on taintings because no taintings are found (i.e., $k=0$), then the auditor is hardly in any position to compute a bound on total error; he does not have enough information. The only way to get around this problem is to develop some more knowledgeable but also less diffuse priors. This is the purpose of assigning ν_0 a value of 2. With this prior, it is possible to compute an N2 bound with as few as one error in the sample. Use of the values $\nu_0=.33$ and $\nu_0=2$ tends to make the N2 bound somewhat higher than if $\nu_0=0$ for the tainting distributions considered here.

TABLE 4
COMPARISON OF BOUNDS
(BOOK VALUE = $1,000,000, 95 PERCENT CONFIDENCE LEVEL, SAMPLE SIZE = 100)
BOUNDS IN THOUSANDS

Number of Errors in Sample	*Tainting Distribution*	*Stringer Bound*	*Modified Multinomial Bound**	*GOLOS*	*CS*	*N2*	*DG***
6 Errors	J	38.9	30.6	35.5	11.9	21.9	25.1
	J-100	54.2	47.3	51.9	31.5	38.6	41.5
	Unimodal	57.2	38.7	47.3	37.6	38.4	42.2
	Uniform	76.5	56.5	64.4	65.2	57.7	66.7
10 Errors	J	45.0	32.8	39.6	18.1	26.5	31.3
	J-100	60.0	49.4	56.0	35.0	43.3	46.7
	Unimodal	73.9	51.4	59.2	55.0	53.7	59.4
	Uniform	103.6	83.4	85.6	94.1	83.8	94.5
15 Errors	J	52.0	36.7	44.5	24.7	32.1	38.2
	J-100	80.5	67.6	65.7	44.7	62.7	67.9
	Unimodal	94.4	71.8	77.1	75.8	72.2	79.5
	Uniform	135.9	116.0	113.0	127.7	113.7	126.3
20 Errors	J	59.1	43.1	49.7	31.5	38.1	44.6
	J-100	87.0	74.7	80.7	60.3	67.7	73.2
	Unimodal	113.7	97.7	94.6	95.0	89.7	97.8
	Uniform	167.1	150.5	140.4	160.0	142.7	156.2
25 Errors	J	65.9	49.0	54.8	37.9	43.9	50.5
	J-100	106.0	93.3	99.2	79.0	86.0	91.9
	Unimodal	132.7	117.4	111.1	113.8	106.9	115.3
	Uniform	197.7	183.2	167.0	191.1	171.0	184.8

* These results were obtained from Table 2 in Leitch, et al. [1982].
** These results were obtained from Table 3 in Dworin and Grimlund [1984].

uniform tainting distributions. Computer simulations were run which first generated a sample of 100 observations from the tainting pattern and error rate indicated; then bounds were computed at a 95 percent confidence level for each such realization of the tainting process. A total of 500 replications of such samples and accompanying bounds were simulated. Statistics were collected on the percentage of correct bounds (i.e., the realized confidence levels) and the distribution of the bounds that resulted.

Tables 3 and 4 summarize the results of these bound calculations on the typical tainting patterns of Leitch, et al. The modified multinomial bounds in Table 4 involve the maximum number of clusters provided by Leitch, et al. Table 5 provides results on the effect of sample size where the error rate remains constant at ten percent. Sample size does not appear to have much impact on comparative bounds.

Since all the bounds are computed using a nominal 95 percent confidence level, it is important also to estimate how close to 95 percent are the realized confidence levels for these bounds. As noted earlier, simulations are useful for making these estimates, and these are provided in Tables 6, 7, 8, and 9. These simulations also confirm that, as in Leitch, et al., the results reported in Tables 3, 4, and 5 using the "typical tainting patterns" are representative of the relative sizes of the bounds. These simulations are based on using the same tainting modeling processes described

TABLE 5

EFFECT OF SAMPLE SIZE ON THE COMPARATIVE TIGHTNESS OF BOUNDS FOR CONSTANT ERROR RATE OF TEN PERCENT
(BOOK VALUE = $1,000,000, 95 PERCENT CONFIDENCE LEVEL)
BOUNDS IN THOUSANDS

Tainting Distribution	*Sample Size*	*Stringer Bound*	*Modified Multinomial Bound**	*GOLOS*	*CS*	*N2*	*DG***
J	60	64.9	50.6	59.0	19.9	37.2	N.A.
	100	45.0	32.8	39.6	18.1	26.5	31.3
	150	34.7	24.6	29.6	16.5	21.5	N.A.
J-100	60	90.3	77.9	86.6	52.5	66.8	N.A.
	100	60.0	49.4	56.0	35.0	43.3	46.7
	150	53.6	45.4	50.4	37.1	41.9	N.A.
Unimodal	60	95.4	63.1	78.8	62.6	65.3	N.A.
	100	73.9	51.4	59.2	55.0	53.7	59.4
	150	62.9	48.3	51.4	50.5	48.4	N.A.
Uniform	60	127.5	92.7	107.4	108.6	98.0	N.A.
	100	103.6	83.4	85.6	94.1	83.8	94.5
	150	90.6	78.2	75.3	85.2	76.3	N.A.

* These results were obtained from Table 3 in Leitch, et al. [1982].
** These results were obtained from Table 3 in Dworin and Grimlund [1984].
N.A. = not available.

TABLE 6

ACHIEVED CONFIDENCE LEVELS FOR THE J DISTRIBUTION
(BOOK VALUE = $1,000,000, 95 PERCENT NOMINAL CONFIDENCE LEVEL, SAMPLE SIZE = 100)

	Error Rate						
Bound	*.03*	*.06*	*.10*	*.14*	*.20*	*.25*	*.60*
SB	100%	100%	100%	100%	100%	100%	100%
Modified Multinomial*	100.	100.	100.	100.	100.	100.	N.A.
GOLOS	100.0	100.0	100.	100.	100.	100.	100.
CS	70.3	77.5	80.4	85.2	84.8	84.4	91.2
N2	100.0	100.0	100.0	100.	99.8	98.8	96.0
DG**	100.0	100.0	100.0	N.A.	N.A.	N.A.	N.A.

* These results were obtained from Table 5 in Leitch, et al. [1982].
** These results were obtained from Table 6 in Dworin and Grimlund [1984].
N.A. = not available.

in Leitch, et al. [1982, pp. 389–390] for the J, $J-100$, unimodal, and uniform distributions. The chi-squared distributions used in modeling the J, $J-100$, and unimodal distributions were not truncated at 100 percent overstatement taintings. When tainting observations were greater than 100 percent, no special actions were

TABLE 7

ACHIEVED CONFIDENCE LEVELS FOR THE J-100 DISTRIBUTION
(BOOK VALUE = $1,000,000, 95 PERCENT NOMINAL CONFIDENCE LEVEL)
FOR THIS DISTRIBUTION, 20 PERCENT OF ALL NON-ZERO TAINTINGS
WERE EXACTLY 100 PERCENT OVERSTATEMENT TAINTINGS.

	Error Rate						
Bound	*.03*	*.06*	*.10*	*.14*	*.20*	*.25*	*.60*
SB	100%	100.%	100.%	99.%	98.8%	99.%	99.%
Modified Multinomial*	100.	100.	100.	95.2	N.A.	N.A.	N.A.
GOLOS	100.	100.	100.	97.6	98.2	98.8	97.8
CS	68.1	75.7	84.6	84.8	87.8	89.2	91.6
N2	100.	99.4	90.8***	93.2	93.4	94.0	95.2
DG**	100.	99.2	96.1	N.A.	N.A.	N.A.	N.A.

* These results were obtained from Table 5 in Leitch, et al. [1982].

** These results were obtained from Table 6 in Dworin and Grimlund [1984].

*** This result appeared to be so out of line with the other achieved confidence levels for the N2 bound that the simulation for this condition was run two more times using different sequences of random numbers. The achieved confidence levels were 91.5 and 94.0, respectively. Clearly, the achieved N2 confidence level for this particular error pattern and sample size is somewhat less than the planned level of .95. The reason for this appears to be that error rates in the range of .1 represent a transition range. For error rates above this transition range, the central limit theorem effect helps assure the validity of the normality assumption and closer correspondence with the nominal confidence level; for error rates below this range, the initializing values assigned to v_o, r_e, v_e, and n_0 tend to have a conservative effect on the bound. Dworin and Grimlund [1984, p. 224] and Neter, Leitch and Feinberg [1978, p. 85] also identify some nonintuitive results for their bounds over a limited range.

N.A. = not available.

TABLE 8

ACHIEVED CONFIDENCE LEVELS FOR THE UNIMODAL DISTRIBUTION
(BOOK VALUE = $1,000,000, 95 PERCENT NOMINAL CONFIDENCE LEVEL)

	Unimodal Distribution						
Error Rate	*.03*	*.06*	*.10*	*.14*	*.20*	*.25*	*.60*
SB	100.%	100.%	100.%	99.8%	99.6%	99.4%	100.%
Modified Multinomial*	100.0	100.0	100.0	95.3	N.A.	N.A.	N.A.
GOLOS	100.0	100.0	100.	99.2	97.0	97.2	94.6
CS	83.9	88.4	93.8	93.0	94.4	96.4	98.2
N2	100.0	100.0	97.0	94.8	94.0	95.0	94.0
DG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

* These results were obtained from Table 5 in Leitch, et al. [1982].

N.A. = not available.

TABLE 9

ACHIEVED CONFIDENCE LEVELS FOR THE UNIFORM DISTRIBUTION
(BOOK VALUE = $1,000,000, 95 PERCENT NOMINAL CONFIDENCE LEVEL)

Error Rate	*.03*	*.06*	*.10*	*.14*	*.20*	*.25*	*.60*
SB	100.%	100.%	99.4%	99.4%	99.8%	99.4%	99.6%
Modified Multinomial*	100	100.	92.4	92.	N.A.	N.A.	N.A.
GOLOS	100	100.0	97.40	96.0	95.8	97.2	95.0
CS	89.7	92.4	94.2	96.4	97.8	97.6	99.2
N2	100.0	97.2	93.6	94.0	95.4	94.8	95.8
DG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

* These results were obtained from Table 5 in Leitch, et al. [1982].
N.A. = not available.

taken and all the bounds continued to be computed as described in Table 1.[5]

In analyzing these tables it is evident that the non-Bayesian bounds have few difficulties with achieved confidence. However, they may still be considered deficient in terms of tightness or efficiency. In this respect the Bayesian N2 bound appears to be superior since in many situations it is tighter than the tightest non-Bayesian bound, yet it may be considered to achieve reasonable confidence levels. Generally, the diffuse N2 bounds are still very conservative in J distributions (Table 6) and all low error rates, but perhaps may not be considered conservative enough for some $J-100$ conditions (Table 7). In addition, for the diffuse priors used here on the Bayesian bounds, the N2 bound may be considered more reliable than the CS bound. Thus the specific form of the Bayesian N2 bound analyzed here may be considered the best bound overall if one considers simultaneously both efficiency and effectiveness.

More generally, the Bayesian bounds have the potential for allowing the auditor to incorporate formally more informative prior information in his calculation of the bound. For example, research by Godfrey and Neter [1984] and other analyses not shown here suggest that, as one might expect, sufficiently conservative priors can be found which result in achieved confidence being greater than planned confidence, if the auditor so desires, for the Bayesian bounds. However, priors that are sufficiently conservative depend on the actual population error rate and mean tainting. The formulas on Table 1 show that the posterior estimate of the rate $\frac{r_1}{n_1}$, and mean, m_1, of nonzero taintings is a weighted average of sample and nondiffuse prior information. Thus, conservative priors are those for which the assessed values of m_0 and p_0 are higher than the actual population values of μ and π. (For N2 this statement also applies to ν_0 and σ^2.) How much higher than actual these priors must be depends on the Bayesian model used and the degree of bound conservatism desired.

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[5] There are several reasons for this. First, empirical evidence by Johnson, Leitch and Neter [1981, p. 288] and Leslie, Teitlebaum, Anderson [1979, pp. 172–173] suggests that while taintings greater than 100 percent overstatements are rare, they nevertheless are possible. This suggests that a small percentage of taintings should be allowed to go beyond 100 percent. Second, all prior research using typical tainting patterns used untruncated chi-squared distributions in simulating sampling results and in computing total error. Hence, in order to facilitate comparability it was necessary not to truncate here. Third, some limited sensitivity analysis suggests that these results are not greatly affected by truncating the chi-squared distributions used here.

Of course, the reader can reach his own conclusions about the need for conservative priors using his own criteria on the data provided here. At the very least, however, this study provides evidence that even when diffuse priors are used, the N2 bound may be quite robust and very competitive with non-Bayesian bounds. This study thus indicates that at least some Bayesian bounds may be used under a broader set of audit conditions, diffuse priors, than indicated by previous research.

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Additional Evidence on the Accuracy of Analyst Forecasts Before and After Voluntary Management Earnings Forecasts

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ABSTRACT: This study examines the relative accuracy of analyst earnings forecasts prepared both before (prior forecasts) and after (posterior forecasts) voluntary management earnings forecasts. The motivation for the study stems directly from recent studies which document statistically significant stock price reactions associated with management forecasts. The results of these studies suggest that management conveys new (or inside) information about earnings through its forecasts. Based on these results, one would expect that management forecasts would be more accurate than prior analyst forecasts while management and posterior analyst forecasts would be equally accurate. This paper reports results fully consistent with both of these predictions. These results, however, are conditional upon *caveats* about the estimation dates for analyst forecasts used to classify them as prior or posterior. Several previous studies have also investigated similar issues but have produced conflicting results. The tests reported here are based on larger samples than those found in previous studies. This suggests that any accuracy differences between management and analysts are of such magnitude that they can be detected only in relatively large samples.

The purpose of this note is to report the results of an investigation into the accuracy of analyst earnings forecasts both before and after the voluntary disclosure of management earnings forecasts. Two primary results are reported: (1) management forecasts are, on average, more accurate than analyst forecasts prepared before management forecasts (referred to as *prior* analyst forecasts), and (2) analyst forecasts prepared after management forecasts (i.e., *posterior* analyst forecasts) are no more accurate than management earnings forecasts.

The motivation for this study stems directly from empirical findings on stock price behavior associated with management forecasts. Early studies (e.g., Patell [1976], Jaggi [1978], Nichols and Tsay [1979], and Penman [1980]) consistently find that management forecasts are asso-

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ciated with statistically significant stock price reactions. More recent studies (see Ajinkya and Gift [1984] and Waymire [1984]) report stock price reactions to such disclosures which are positively correlated with the "unexpected" component of such projections. In short, these studies strongly suggest that management forecasts provide new information not previously reflected in investors' beliefs about the firm's earnings prospects.

Based on this evidence and other results which suggest that analyst forecasts are reliable surrogates for investor earnings expectations (see Brown and Rozeff [1978] and Fried and Givoly [1982]), it seems plausible that management forecasts would be more accurate than prior analyst forecasts.[1] Of course, the empirical observation that management forecasts are more accurate than prior analyst forecasts is not necessarily conclusive evidence that management conveys new information through its forecasts. An alternative interpretation of such a finding would be that since management forecasts are disclosed later than prior analyst forecasts, they are based on a greater level of publicly available information and should, therefore, be more accurate. However, applying this conjecture further implies that posterior analyst forecasts should be more accurate than management forecasts since they, in turn, are based on a greater amount of publicly available information.

Since the evidence in this paper indicates that management forecasts are more accurate than prior analyst forecasts and posterior analyst forecasts are no more accurate than management forecasts, observed accuracy differences are the likely artifact of inside information held by the manager at the time of his/her forecast release. However, this conclusion is a qualified one since the results on posterior analyst forecasts hinge on the accuracy of analyst forecast estimation dates reported in Standard and Poor's *Earnings Forecaster*, the primary data source for this study. Abdel-khalik and Ajinkya [1982] find that some analysts generally provide their forecasts to select clients prior to making a broader disclosure. Further, discussions with employees of Standard and Poor's responsible for compiling the *Earnings Forecaster* indicate that the analyst forecasts they publish have been selectively disclosed to select clients in advance of a broader public dissemination. The effect of this is that some forecasts classified as posterior may, in fact, have been prepared prior to management forecast disclosure. The tests reported here are designed to provide some (although not complete) control for the early disclosure phenomenon. However, since the exact effects of such lags on the posterior analyst forecast results cannot be quantified, caution must be exercised in interpreting such results.[2]

Several recent studies also investigate the comparative accuracy issue but provide less than conclusive results. Neither Basi, Carey, and Twark [1976] nor Ruland [1978] are able to reject the null hypothesis of equal accuracy between management and prior analyst forecasts even though they both find some tendency for management forecasts to be more accurate. Ruland also finds management and posterior analyst forecasts to be equally accurate. Jaggi [1980] finds management forecasts to be more accurate than prior analyst forecasts and equally accurate relative to posterior analyst forecasts. Two related studies by Imhoff [1978] and Imhoff and Paré [1982] find management forecasts and contemporaneous analyst forecasts to be equally accurate. However, the findings of the Imhoff and Imhoff and Paré studies are not strictly comparable to the current findings or those in other studies since no discrimination is made between prior and posterior analyst forecasts.

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[1] Additional evidence indicates that analysts incorporate a wide body of information into their expectations, likely making them superior measures of current market expectations. See, e.g., Pankoff and Virgil [1970], Abdel-khalik and Espejo [1978], Brown and Rozeff [1979a, 1979b], Collins and Hopwood [1980], and Brown [1983].

[2] The only way to estimate precisely the effect of this on the results is to obtain directly from the analyst the dates on which the forecasts are estimated. Since a number of investment analysts provide forecasts to the *Earnings Forecaster*, collection of such data is, at worst, infeasible and, at best, highly costly.

The results of this study are consistent with those of Jaggi [1980]. A potential explanation for this outcome is the sample sizes employed in the various studies. For example, this study and that of Jaggi employ larger samples than the other comparative accuracy studies. This suggests that management forecasts are probably more accurate than prior analyst forecasts, but the differences are of such magnitude that they can be detected only in relatively large samples.

An additional *caveat* about the analyst forecast data employed in this study is warranted at the outset. Within the *Earnings Forecaster* data base, there appears to be some selectivity of analyst following. For example, larger firms tend to have greater availability of analyst forecasts and more recent analyst forecasts. This could reflect either a greater following in the investment community or selectivity in the types of analysts who choose to report their forecasts to Standard and Poor's. Thus, the present results may not be generalizable to analyst forecasts not reported in the *Earnings Forecaster.*

The remainder of the note is organized as follows. Section 1 describes the data employed while Section 2 outlines the research method. Empirical results are reported in Section 3 and Section 4 provides a summary.

1. THE DATA

Management Forecast Observations

The management forecast sample consists of 425 projections of annual earnings per share reported in *The Wall Street Journal* between 1/1/70 and 12/31/73. The sample is identical to the one analyzed in Waymire [1985] except that 41 management forecasts in that sample disclosed between 7/1/69 and 12/31/69 have been deleted. The reason for this is that prior to 12/19/69, the *Earnings Forecaster* did not provide estimation dates for analyst forecasts. These estimation dates are necessary to classify analyst forecasts as either prior or posterior and, thus, are critical for the empirical tests.

All observations are forecasts drawn originally from the sample collected by Penman [1980] and represent projections of current year annual primary earnings per share released in the first 11 months of the company's fiscal year. All forecasts are either point projections or range estimates where the midpoint was taken as the forecast. These data have been subjected previously to selection requirements relating to stock returns and analyst forecast data. For further elaboration on selection of the original sample, see Waymire [1984, 1985].

Most of the firms are represented by only one forecast in the final 425-observation sample (only one firm has a forecast in the final sample in each of the four years). The sample is dominated by manufacturing firms and transportation and public utility firms. Most have 12/31 fiscal year ends and are listed on the New York Stock Exchange. With respect to timing, fewer forecasts are disclosed in the first quarter of the company's fiscal year and more are disclosed in the latter half of the sample period (1972-73).[3]

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[3] Results describing the properties of this sample with respect to these characteristics are available upon request from the author.

TABLE 1

DESCRIPTIVE STATISTICS

ANALYST FORECAST DATA COLLECTED FROM LAST ISSUE OF *EFCML* SAMPLED

Number of Analyst Forecasts Available[a]					
1	*2*	*3*	*4*	*≥5*	*Total*
160 (37.6%)	116 (27.3%)	82 (19.4%)	32 (7.5%)	35 (8.2%)	425 (100.0%)

Time Lags Between Estimation and Publication Dates of MRAF Observations—In Terms of Number of Days[b]

	Mean	*Min.*	*Med.*	*Max.*	*#1–14 Days*	*#15–28 Days*	*#29–49 Days*	*#≥50 Days*	*Total*
All MRAF Observations	36.05	2	25	171	94	83	70	87	334
New MRAF Observations Only[c]	14.12	2	11	98	94	50	10	2	156

[a] This computation includes forecasts prepared by analysts employed at Standard and Poor's.

[b] The computation includes weekends and holidays.

[c] New MRAF observations are those which were not available in the prior issue of *EFCML*.

Analyst Forecast Data

Measures of prior and posterior analyst forecasts are obtained by sampling issues of the *Earnings Forecaster-Cumulative Master List (EFCML)* in the time period around the date of management forecast disclosure in *The Wall Street Journal.* The *EFCML* is published biweekly with a shorter publication detailing updates to the previous week's analyst forecasts published during other weeks. To simplify data collection, the biweekly updates to *EFCML* are not employed.

Three *EFCML* issues are employed in the sampling process, the one immediately before and the two immediately following the date of management forecast publication in *The Wall Street Journal.* For each of these three issues of *EFCML,* I collected the most recent analyst forecast (MRAF) where it could be identified. The MRAF is defined as the analyst forecast with a listed estimation date closest to the date of EFCML publication.[4] This selection procedure necessarily excludes forecasts prepared by analysts employed at Standard and Poor's. Estimation dates are provided for the forecasts supplied by other investment analysts, whereas the forecasts by Standard and Poor's own analysts are listed only as current projections without any specific estimation date. Because some firms have forecasts only by Standard and Poor's, the MRAF measure is available for 330 (77.6 percent), 333 (78.4 percent), and 334 (78.6 percent) of the 425 sample observations for the first, second, and third issues of *EFCML* issues sampled, respectively. It should be noted that Standard and Poor's own analysts do not provide forecasts for all firms listed in *EFCML.*

From these data, a prior and a posterior analyst forecast are selected in the following manner. For each of the sample observations, the three MRAFs are classified as either prior or posterior depending on whether the analyst forecast estimation date provided in *EFCML* is before or after, respectively, the date of management forecast disclosure in *The Wall Street Journal.* Because three separate issues of *EFCML* are sampled, a number of cases arise where more than one MRAF is classified as either prior or posterior. In such cases, the MRAF with estimation date closest to management forecast publication date is employed. In all, this process yields 335 usable prior forecasts and 131 posterior forecasts.[5]

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[4] In some cases, more than one analyst forecast was estimated on the same date. In such cases, an average of the two was taken as an estimate of the MRAF measure.

Discussion with Standard and Poor's employees indicates that the estimation dates provided in *EFCML* refer to the dates on which the analysts first make a broad public disclosure of their forecasts. Standard and Poor's indicates that virtually all the forecasts are disclosed to select clients before this date. The time lags between selective disclosure and a broader public disclosure are usually one to two weeks, although in some cases it can be one month. Thus, some of the forecasts classified as posterior may have been prepared before management forecast disclosure. The tests in Section 4 are designed to provide some (although incomplete) control for this classification problem.

For descriptive purposes, some properties of the analyst forecast data are shown in Table 1. These data are taken from the final issue of *EFCML* sampled, i.e., the second issue of *EFCML* following management forecast disclosure. Similar summary statistics were computed for the other two issues sampled. Because of the high degree of similarity, those statistics are not reported.

Three points about these data are worthy of mention. (1) The overall number of analyst forecasts appears to be quite low. One hundred-sixty (37.6 percent) of the observations have only one analyst forecast available whereas only 35 (8.2 percent) have five or more. (2) The data contain several old analyst forecasts. Eighty-seven of the 334 (26.0 percent) MRAF observations are at least 50 days old.[6] (3) New MRAF forecasts are those which did not appear in the preceding *EFCML* issue and as such give some indication of the time lag between estimation of the analyst forecast and when it is first published in *EFCML.*[7] Note that 12 of 156 (7.7 percent) are estimated at least four weeks prior to *EFCML* publication. Discussion with S&P employees suggests that, in some cases, there can be lengthy time lags in submitting new analyst forecasts to *EFCML* after public disclosure.

Average time lags between estimation and publication of MRAF for selected subsamples are reported in Table 2. Four points are noteworthy. (1) The time lags are, on average, shorter for larger firms and NYSE firms. (2) The time lags, on average, decline as the number of available analyst forecasts increase. (3) Firm size and exchange listing are associated with the number of available analyst forecasts. For example, of 171 large firms where an MRAF could be obtained, 67 (37.2 percent) have only one analyst forecast whereas 102 of 163 (62.6 percent) of the small firms have only one analyst forecast available. This result is consistent with other studies which have documented an association between firm size and level of following in the investment community (see Grant [1980], Atiase [1984], and Richardson [1984]). (4) Holding the number of analyst forecasts constant, there appear to be *no* systematic differences in average time lags for large and small firms

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[5] The reason why the total number of usable prior forecasts exceeds the total number of MRAF for any given issue of *EFCML* is that some firms drop out on later issues and new firms enter.

[6] These numbers understate the average age of forecasts listed in *EFCML* since only the most current forecasts are sampled.

[7] These are not perfect estimates of average publication lags for new forecasts because: (1) only the most current projections are included, and (2) some may have been published a week earlier in the *EFCML* biweekly update.

TABLE 2

AVERAGE TIME LAGS BETWEEN ESTIMATION AND PUBLICATION OF MRAF IN LAST ISSUE OF *EFCML* SAMPLED—SELECTED SUBSAMPLES ONLY (SAMPLE SIZE FOR COMPUTED AVERAGES IN PARENTHESES)

		Number of Analyst Forecasts Available to Compute MRAF[a]			
All MRAF	*Overall Mean*	*1*	*2*	*3*	*≥4*
Total Sample	36.05 (334)	49.18 (169)	27.25 (89)	17.88 (40)	16.42 (36)
Large Firms Only[b]	30.93 (171)	44.99 (67)	26.57 (49)	19.14 (22)	16.73 (33)
Small Firms Only[b]	41.43 (163)	51.93 (102)	28.08 (40)	16.33 (18)	13.00 (3)
NYSE Firms Only	34.09 (271)	47.56 (124)	27.45 (77)	18.60 (35)	16.46 (35)
ASE Firms Only	44.49 (63)	53.62 (45)	25.92 (12)	12.80 (5)	15.00 (1)
New MRAF Only[c]					
Total Sample	14.12 (156)	19.24 (50)	12.37 (54)	9.92 (25)	12.00 (27)
Large Firms Only[b]	12.93 (93)	16.38 (21)	12.76 (34)	9.93 (14)	11.88 (24)
Small Firms Only[b]	15.87 (63)	21.31 (29)	11.70 (20)	9.91 (11)	13.00 (3)
NYSE Firms Only	13.32 (132)	17.78 (36)	12.31 (49)	9.81 (21)	11.88 (26)
ASE Firms Only	18.50 (24)	23.00 (14)	13.00 (5)	10.50 (4)	15.00 (1)

[a] This represents the number of analyst forecasts from which MRAF selection could take place. It excludes forecasts by S&P analysts since no specific estimation date is provided for such projections.

[b] Large firms are defined as those whose total assets per the balance sheet for the forecast year exceeds the median for the entire 425-observation sample. Small firms represent the strict complement of this set.

[c] New MRAF observations are those which were not available in the prior issue of *EFCML*.

or NYSE and ASE firms.[8]

Based on these observations, large firms (or NYSE firms) have more recent analyst forecasts available in *EFCML*. This is not due to specific analysts updating more frequently for these firms but rather is the artifact of being followed by a greater number of analysts.

2. RESEARCH METHODS

Error Metrics

Two alternative measures of forecast accuracy are employed. They are:

$$\text{Metric 1} = \left| \frac{\text{Actual EPS} - \text{Forecasted EPS}}{\text{Actual EPS}} \right|$$

and

$$\text{Metric 2} = \left| \text{Actual EPS} - \text{Forecasted EPS} \right|$$

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[8] The motivation for holding number of analyst forecasts constant is straightforward. Because of the way that MRAF is defined, we are calculating the *minimum* time

Metric 1 represents an absolute value percentage error metric and is commonly employed in comparative accuracy studies. Metric 2 is a raw absolute value forecast error. Metric 2 is employed to supplement Metric 1 since, for the present sample, absolute percentage forecast errors are likely to be negatively correlated with firm size, whereas absolute raw forecast errors are not (see Waymire [1985]). Since one of the tests employed in the study is sensitive to cross-sectional differences in forecast error magnitude, it seems reasonable to employ more than one metric.[9]

Statistical Tests

Two tests of statistical significance are applied to the error metrics for pairwise comparisons of management and analyst forecasts. The first is the Wilcoxon Matched Pairs Signed-Rank Test. The test is applied only to cases of forecast disagreement, i.e., cases where management and analyst forecasts differ. Thus, the null hypothesis tested via the Wilcoxon test is that the distributions of a given metric for the two groups are identical, conditional upon a disagreement between management and analyst forecasts. Further, since cases of agreement are discarded, two-tailed tests of significance must be applied.

This test is selected for several reasons. (1) The metrics probably are drawn from non-normal distributions, making a parametric *t*-test for mean differences inappropriate. (2) While the exact hypothesis is one of different distributions, the test is particularly sensitive to differences in central tendency. (3) The test requires no assumption of independence between management and analyst forecast errors, a condition which probably is violated. (4) The test has been used previously in accuracy studies (e.g., Lorek, McDonald, and Patz [1976], Ruland [1978], and Jaggi [1980]). Thus, use of the test improves comparability of the present results with previous findings.

The Sign Test for Matched Pairs is also employed to complement the Wilcoxon test. Likewise, the test is applied only to cases of disagreement between management and analyst projections. The test is conducted by determining the number of cases where management is more accurate (in terms of lower error metric) and the number of cases where the analyst is more accurate. The test then assesses the probability that the observations are drawn from a population where the frequency of these two events is equal.

Since the Wilcoxon and Sign tests are applied to identical data, they cannot be interpreted as independent tests. The primary motive for using the Sign test is that it will produce identical results for both metrics. The Wilcoxon test could potentially produce conflicting results across metrics since it employs information about both sign and magnitude of error metric differences. For a description of both tests, see Sachs [1982].

3. EMPIRICAL RESULTS

Summary statistics for Metric 1 are provided in Table 3 while Table 4 provides replication of these results using

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lag for the available analyst forecasts in *EFCML*. Intuitively, one would expect that the expected value of the sample minimum would decline as the sample size increases. Thus, to draw inferences about the association between time lags for MRAF and firm characteristics, it is necessary to hold the sample size (i.e., number of analyst forecasts) constant.

[9] Waymire [1985] finds Metric 2 not to be significantly correlated with firm size while Metric 1 exhibits a significant negative association with firm size. Further, this appears to be the result of a large positive correlation between size and level of EPS (either actual or forecasted). Thus, Metric 1 may not standardize for the effects of cross-sectional differences in size. Based on this, it seems sensible to replicate the tests using both metrics to see whether the choice of metric makes a difference. For a more general discussion of issues involved in standardizing financial variables to control for cross-sectional variation in size, see Lev and Sunder [1979].

TABLE 3
SUMMARY STATISTICS
ERROR METRIC 1[a]
MANAGEMENT VS. ANALYST FORECASTS

	Sample Size	*Mean*	*Median*	*Significance Level[b] Wilcoxon Test*	*Number of Cases Where MF More Accurate*	*Number of Cases Where AF More Accurate*	*Significance Level[b] Sign Test*
Management Forecasts	216	.1231	.0385	.002	130	54	.01
Prior AF Estimated More Than 14 Days Before MF Disclosure	216	.1710	.0716				
Management Forecasts	119	.0733	.0385	.002	60	38	.02
Prior AF Estimated 1–14 Days Before MF Disclosure	119	.0821	.0521				
Management Forecasts	104	.1147	.0383	ns at .05 level	43	33	ns at .05 level
Posterior AF Estimated 1–14 Days After MF Disclosure	104	.1302	.0403				
Management Forecasts	27	.1860	.0404	ns at .05 level	12	11	ns at .05 level
Posterior AF Estimated More Than 14 Days After MF Disclosure	27	.2300	.0430				

[a] Error Metric 1 = $\left|\dfrac{\text{Actual EPS} - \text{Forecasted EPS}}{\text{Actual EPS}}\right|$

[b] Significance test is two-tailed.

TABLE 4
SUMMARY STATISTICS
ERROR METRIC 2[a]
MANAGEMENT VS. ANALYST FORECASTS

	Sample Size	*Mean*	*Median*	*Significance Level*[b] *Wilcoxon Test*	*Number of Cases Where MF More Accurate*	*Number of Cases Where AF More Accurate*	*Significance Level*[b] *Sign Test*
Management Forecasts	216	.1655	.0780	.002	130	54	.01
Prior AF Estimated More Than 14 Days Before MF Disclosure	216	.2441	.1300				
Management Forecasts	119	.1371	.0800	.002	60	38	.02
Prior AF Estimated 1–14 Days Before MF Disclosure	119	.1858	.1000				
Management Forecasts	104	.1767	.0800	ns at .05 level	43	33	ns at .05 level
Posterior AF Estimated 1–14 Days After MF Disclosure	104	.1766	.0650				
Management Forecasts	27	.1553	.1000	ns at .05 level	12	11	ns at .05 level
Posterior AF Estimated More Than 14 Days After MF Disclosure	27	.1814	.1100				

[a] Error Metric 2 = $\left| \frac{\text{Actual}}{\text{EPS}} - \frac{\text{Forecasted}}{\text{EPS}} \right|$

[b] Significance test is two-tailed.

Metric 2. Recall that the Sign test will produce identical results across the metrics, whereas the Wilcoxon has the potential to produce different results. The results of the Wilcoxon test are quite similar for both metrics, suggesting that error metric choice does not strongly influence the conclusions of this study.

The results provide strong support for the hypothesis that management forecasts are more accurate than prior analyst forecasts. For the tests using the prior analyst forecasts, both the Wilcoxon and Sign tests reject the null hypothesis of equal accuracy at reasonable significance levels ($\alpha \leq .05$). Further, for such comparisons, the mean and median values of both metrics are lower for management forecasts, and management forecasts are more accurate in a greater number of cases.

Like the prior analyst forecasts, the posterior forecasts have been partitioned into two groups based on the lag between management forecast publication and reported estimation date in *EFCML*. Based on the Abdel-khalik and Ajinkya [1982] results and discussions with people at Standard and Poor's, I would expect that those forecasts with estimation dates one to 14 days after management forecast publication would contain a higher proportion of analyst forecasts prepared prior to management forecast publication. Two points about the posterior forecast tests are noteworthy. First, in no case is the hypothesis of equal accuracy rejected. Second, there is some weak evidence of a classification error problem. For the analyst forecasts with estimation dates one to 14 days after management forecast publication, management forecasts are more accurate in 43 cases, whereas analysts are more accurate in 33 cases. For the analyst forecasts with estimation dates more than 14 days after management forecast publication, the frequencies of management and analyst superiority are almost equal (12 vs. 11). However, applying a chi-square test of independence to these frequencies does not yield significant results at the .05 level. This result and the inability to reject the null hypothesis of equal accuracy between management and posterior analyst forecasts suggests that the classification problem is not particularly severe.

As a check on the results, comparative accuracy tests between management forecasts and forecasts prepared by S&P's own analysts are conducted. Recall that forecasts by S&P analysts are listed in *EFCML* as "current" projections without any specific estimation dates. Table 5 shows the results of comparisons between management forecasts and S&P analyst forecasts denoted SP1, SP2, and SP3 using Error Metric 1. (The inferences are identical using Error Metric 2 and those results are omitted for the sake of brevity.) SP1, SP2, and SP3 refer to S&P analyst forecasts published in the first, second, and third issues of *EFCML* sampled, respectively. Since the first issue of *EFCML* sampled is published prior to management disclosure, the SP1 forecasts can be unambiguously defined as prior analyst forecasts. However, because of unspecified estimation dates, the SP2 and SP3 forecasts may be either prior or posterior.

The findings in Table 5 are consistent with the results on prior analyst forecasts using the MRAF observations. Note that the mean and median are lower for management forecasts relative to SP1 and management forecasts are more accurate in a greater number of cases. Both tests reject the null at reasonable significance levels ($\alpha \leq .05$). The results also suggest that management forecasts are more accurate than both SP2 and SP3. The Wilcoxon test rejects the null in both cases while the Sign test rejects for SP2.

The results on the SP2 and SP3 fore-

TABLE 5
SUMMARY STATISTICS
ERROR METRIC 1[a]
MANAGEMENT VS. STANDARD AND POOR'S ANALYST FORECASTS

	Sample Size	*Mean*	*Median*	*Significance Level[b] Wilcoxon Test*	*Number of Cases Where MF More Accurate*	*Number of Cases Where AF More Accurate*	*Significance Level[b] Sign Test*
Management Forecasts	330	.1029	.0385	.002	184	99	.01
SP1[c]	330	.1353	.0622				
Management Forecasts	331	.1044	.0385	.002	155	104	.01
SP2[c]	331	.1210	.0508				
Management Forecasts	332	.1043	.0385	.002	128	112	ns at .05 level
SP3[c]	332	.1125	.0464				

[a] Error Metric 1 = $\left| \dfrac{\text{Actual EPS} - \text{Forecasted EPS}}{\text{Actual EPS}} \right|$

[b] Significance test is two-tailed.

[c] SP1, SP2, and SP3 refer to forecasts prepared by analysts employed by Standard and Poor's taken from the first, second, and third issues of *EFCML* sampled. The first issue of *EFCML* sampled was published prior to management forecast disclosure, whereas the second and third issues were published after management forecast disclosure.

casts are consistent with three alternative explanations. (1) The S&P forecasts were not updated after the management forecast release, and thus represent prior analyst forecasts. (2) The S&P forecasts were updated after the management forecast, but because of limited information search the management forecast went undetected. (3) The S&P forecasts were updated after the management forecast, and the management forecast was detected, but not believed, by the S&P analysts.

Discussions with Standard and Poor's employees revealed that the S&P forecasts are updated on a daily basis. Further, this has been their policy since inception of the data base in the 1960s. Thus, interpretation (1) probably does not explain the results. Interpretations (2) and (3) cannot be empirically discriminated. Thus, the SP2 and SP3 forecast results are consistent with the posterior MRAF results *only* in the sense that neither test finds posterior analyst forecasts to be more accurate than management projections.

4. SUMMARY

The accuracy of analyst earnings forecasts before and after voluntary management forecasts was investigated in this study. The results suggest that management forecasts are more accurate than prior analyst forecasts and posterior analyst forecasts are no more accurate than management forecasts. Based on the evidence, it seems reasonable to conclude that accuracy differences are the likely artifact of inside information held by the manager at the time of forecast disclosure. This conclusion is, of course, subject to the *caveats* regarding estimation dates for analyst forecasts employed in this study.

Further, such a conclusion appears consistent with other empirical findings reported in several studies on stock price behavior associated with management earnings forecasts. Early studies (e.g., Patell [1976], Jaggi [1978], Nichols and Tsay [1979], and Penman [1980]) detect significant stock price reactions to management earnings forecasts. Later studies (e.g., Ajinkya and Gift [1984] and Waymire [1984]) find such stock price reactions to be positively associated with the "unexpected" component of management forecasts. Evaluated collectively, these results provide further support for the assertion that voluntary management forecasts convey information not previously available to investors.

The results are also important in resolving some potentially conflicting findings which previously appeared in the literature. Basi, Carey and Twark [1976] and Ruland [1978] were unable to reject the null hypothesis of equal accuracy between management and prior analyst forecasts even though in qualitative terms management had a comparative accuracy edge. Ruland [1978] also found management and posterior analysts forecasts to be equally accurate. On the other hand, Jaggi [1980] finds management forecasts to be more accurate than prior analyst forecasts and as accurate as posterior forecasts. A potential explanation for such inconsistencies may lie in sample size issues. For example, this study and that of Jaggi [1980] employ larger samples than those used in other studies. Thus, it appears as though any comparative accuracy differences are of such magnitude that they can be detected only in large samples.

Finally, the conclusions of the study are subject to a *caveat* about the data. Within the *Earnings Forecaster* data, there appears to be some selectivity of analyst following. This may reflect either actual differences in investment community following, or it may be an artifact of the types of analysts who choose to report their forecasts to Standard and Poor's. This implies that the results may not be strictly generalizable to analyst forecasts not reported in the *Earnings Forecaster.*

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EDUCATION RESEARCH

Jack E. Kiger, Editor

The Role of Productive Thinking in Affecting Student Learning with Microcomputers in Accounting Education

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ABSTRACT: This study investigates the role of productive thinking in affecting student attitudes toward, and performance with, microcomputer spreadsheet programs in a managerial/cost accounting course. Productive thinking is defined as thinking based on an understanding of the nature of problems rather than on memorization of facts and rules. In this experiment covering two academic quarters, students initially indicated strong desire to use microcomputers, but their enthusiasm diminished after the classroom experience with their use. Although there was no performance difference across integrative versus non-integrative assignments, performance was positively related to previous computing experience. Students did feel, however, that computers should be used in other accounting courses. Students also reported that they experienced greater learning with integrative course assignments than with repetitive, non-integrative assignments. This finding suggests that a benefit of computer use in teaching accounting may be the opportunity it offers for problem solving based on understanding rather than on memorization.

CONSISTENT with the rapid growth of microcomputer use in accounting practice [*Journal of Accountancy*, 1983; Data Decisions, 1983; Connors, 1983; Borthick and Scheiner, 1984], the use of microcomputers is increasing in accounting education [Thomas, 1983a]. If current trends continue, nearly all accountants will be making substantial use of computing in their daily work within a few years. The growth in microcomputer use in accounting education reflects the perceived need of accounting graduates

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to be prepared for careers in which accounting systems often mean computer systems.

The literature on microcomputer use in accounting education, however, concentrates on implementation experiences of instructors and largely ignores the effects of microcomputer use on student learning. As computer technology is integrated into accounting education, it becomes increasingly necessary to investigate systematically the relationship of using microcomputers in the classroom to student learning.

Thomas [1983b] and Wu [1984] asserted that use of microcomputers helps students think more analytically. If so, use of microcomputers should help prepare students for careers in which analyzing accounting data is more important than performing mechanical accounting procedures. Similarly, the use of microcomputers has been assumed to promote an appreciation of the role of algorithmic statements of accounting processes. Ijiri [1983, p. 173] observed that training in algorithmic thinking "is grossly missing in . . . accounting education due to its traditional use of the illustrative method."

Given the need to develop students' ability to think analytically and algorithmically and the predicted potential of microcomputers to promote this ability, academicians seem to have concluded that microcomputer use is and will continue to be a positive and significant factor in assisting students in the process of learning accounting. Research findings by Kulik, Kulik and Cohen [1980] and Ellsworth and Bowman [1984] indicated, however, that the impact of microcomputer use on learning was less than expected. Since educational institutions and their faculties are allocating significant resources to microcomputer use, it is appropriate for accounting educators to assess the effect of microcomputer use on student learning.

Two important aspects of student learning are attitude and performance. Attitude is important because it indicates one's receptiveness to and expectations about topics to be mastered. In addition, attitude may be a proxy for the perceived value of the subject matter one is learning. In this study, attitude is a proxy for student perceptions of the value of microcomputer use in learning accounting.

Notwithstanding predictions of the potential value of computing in accounting education, there is little information on its consequences.[1] Given the formative stage of the integration of computing into accounting education, it is important for teachers to help students develop reasonable expectations of the difficulty of, and the time required for, accomplishing learning objectives. If, for example, students underestimate the effort required to gain computer proficiency, they may become needlessly frustrated both with the subject matter and computer use.

The purpose of this paper is to measure the role of learning based on understanding rather than on memorization in affecting student attitudes toward, and performance with, microcomputer use in accounting education. In the psychological literature, learning based on understanding is called productive thinking [Wertheimer, 1959; Bower and Hilgard, 1981, pp. 321–325]. The next section discusses the theory of productive thinking and develops five hypotheses for empirical investigation. Next, the data collection procedures are described, followed by a presentation of the results. The last section summarizes the findings and offers conclusions and implications.

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[1] Friedman [1981] found that intermediate accounting students using instructor-prepared programs via time sharing performed significantly better on the AICPA Achievement Test than students who did not use the programs. Groomer [1981] found that students using PLATO tutorials performed better than those helped by human tutors.

THE ROLE OF PRODUCTIVE THINKING IN LEARNING ACCOUNTING

One use of analytical and algorithmic thinking in problem solving involves the application of Gestalt perceptual principles to education [Wertheimer, 1959]. Wertheimer held that understanding the underlying principles which structured a given task enhanced problem-solving abilities more than simple rote memorization of facts and rules. In his experiments, learning based on an understanding of the principles involved in problem-solving situations was more thorough and was retained longer than learning based on rote memorization. He used the term *productive thinking* to denote insightful learning based on an understanding of the underlying nature of the problem. According to this view, learning occurs as the learner gains insight into the problem. In Wertheimer's experiments, such learning was more generalizable than learning resulting from rote memorization.

Inducing Productive Thinking

In the Gestalt tradition, learning is viewed as a process of differentiation in which the learner applies general principles to specific structures or problems. Aware of the general principles, the learner thinks about the ingredients in a problem until coming to see the solution, i.e., solving the problem. Understanding general principles first should help the learner know how specific applications occur and the ways in which they relate to the whole. Solutions obtained this way are retained for longer periods of time and are more general than solutions obtained by memorizing facts and rules [Wertheimer, 1959, pp. 234–259].

Given the large number of computational procedures in accounting, e.g., earnings per share determination, pension liability valuation, lease amortization, and inventory costing, it is difficult for instructors to help students grasp general principles which organize the field and motivate specific applications. In addition, the time required for calculations with pencil, paper, and calculator leaves many students little opportunity to pursue underlying principles. Computer use has the potential for reducing the amount of time students must spend on purely computational aspects of accounting, thus creating an opportunity for a more holistic approach to learning. Until microcomputers and spreadsheet programs were available, computer use was deemed too costly and too time consuming for widespread use in accounting education. The growing availability of microcomputer resources now means accounting educators are able to spend more time helping students grasp organizing principles.

Like other accounting texts, managerial/cost texts cover specific applications in separate chapters. To understand managerial/cost accounting, however, students must see the general principles organizing these concepts into a coherent whole. Without unifying principles, individual applications are merely computational procedures dictated by procedural rules.

The traditional approach to accounting pedagogy has been to illustrate individual concepts through multiple, relatively short problems. This approach is based, at least in part, on the belief that repetition contributes to the learning process. For example, an instructor might assign three problems concerning the same basic concept with each problem featuring a slightly different aspect of the concept. With the computer, students could prepare solutions to more problems and thereby increase the probability of accomplishing the learning objective. Gestalt theory implies that such an approach has limited effectiveness because of the lack of opportunity for the learner to perceive how concepts are interrelated and the ways in which they belong to the same overriding concept.

A primary benefit of computer use may be the opportunity it provides for learning general concepts and applying them in specific task situations. With a microcomputer, students could solve integrative problems, instilling more general concepts which motivate specific applications. Such an integrative approach would provide a more effective learning experience than learning procedures based on memorization of facts and rules. Based on Gestalt theory, the following proposition was formed:

> Working an integrative problem on a computer will provide a more positive learning experience than working repetitive problems on a computer.

Working a comprehensive integrative case should require greater cognitive effort than working multiple repetitive problems because working with the integrative case requires students to work simultaneously with concepts from multiple chapters. The benefit from such an integrative approach should be increased student perception of the interrelatedness of the material and, consequently, more insightful understanding of the material. To test the ability of microcomputer use to induce productive thinking, the following hypotheses were formed:

Hypothesis One:
> Students prefer to work a large number of small problems on the computer rather than one large integrative case, but their perception of learning will be greater with the integrative case.

Hypothesis Two:
> Student performance will be higher for students preparing an integrative case than for students working many small problems.

Understanding Versus Memorization

If students merely memorize the steps required for solving each different kind of problem, their learning of accounting is rote memorization. Indeed, the computational burden of individual procedures tends to limit the amount of time students spend developing the insights required to understand the underlying nature of accounting. A good learning situation for accounting is analogous to that for statistics, in which students rely on computers for lengthy calculations and spend most of their time learning statistical concepts. Microcomputer use, however, has the potential to ease the computational burden of executing accounting procedures, thus allowing more opportunity for students to develop problem-solving insights. Consequently, microcomputer use should promote student learning of accounting. To investigate the attitudinal aspect of this premise, the following proposition was formed:

> Students believe that microcomputer use will promote their learning of accounting.

To test this proposition, three specific research hypotheses were framed:

Hypothesis Three:
> Using microcomputers increases student desire to use microcomputers generally.

Hypothesis Four:
> After using microcomputers, students will believe microcomputers should be used in other accounting courses.

Hypothesis Five:
> After using microcomputers, students will believe using microcomputers helps them learn accounting.

If microcomputer use promotes learning directly or makes learning easier by

TABLE 1
MEANS OF RESPONSES BY TREATMENT AND SECTION

Treatment and Section	*PRE/DES*	*POS/DES*	*OTHER*	*LEARN*
Problems: Fall Quarter				
Section 1 ($N=19$) [Instructor 1]	4.53	3.45	3.53	3.16
Section 2 ($N=26$) [Instructor 2]	4.31	3.58	3.88	3.04
Sections 1 and 2 ($N=45$)	4.40	3.52	3.73	3.09
Case: Winter Quarter				
Section 3 ($N=21$) [Instructor 1]	4.43	3.00	3.81	3.57
Section 4 ($N=26$) [Instructor 1]	4.19	1.82	4.35	3.85
Sections 3 and 4 ($N=47$)	4.30	2.35	4.11	3.72
Overall				
All sections ($N=92$)	4.35	2.92	3.92	3.41

Note: PRE/DES = Desire to use microcomputers before taking course
POS/DES = Desire to use microcomputers after taking course
OTHER = Desire to use microcomputers in other courses
LEARN = How microcomputers helped learning

reducing the computational burden, then after using microcomputers in a learning experience, students should want to use microcomputers in other accounting courses. Students should also perceive that microcomputer use contributes in a positive way to their learning.

The five hypotheses stated above were tested through a classroom experiment. The next section describes the experiment.

THE EXPERIMENT

The experiment was conducted in all sections of the junior/senior managerial/cost accounting course (five quarter hours of credit) during two successive quarters, Fall 1983 and Winter 1984. There were two sections of the course each quarter. Instructor 1 taught one fall quarter section and both winter quarter sections; instructor 2 taught one fall quarter section. Attitude and performance measures were obtained for the 92 students completing the course. Table 1 shows the number of students by section and quarter. Five other students were enrolled but dropped the course by the drop deadlines midway through the quarters, giving an overall drop rate of 5.1 percent. This drop rate was consistent with the drop rate in previous quarters. One student taking the course fall quarter repeated the course winter quarter.

Before fall quarter, microcomputer use had not been part of the course, and none of the fall quarter students had advance knowledge that they were to use microcomputers. As expected, most students in winter quarter sections were aware of the microcomputer use the previous quarter and anticipated using microcomputers. All students had taken a principles of accounting course (financial and managerial), and most of them had completed an intermediate financial accounting sequence.

Treatments: Problems and Integrative Case

During the fall quarter, students were required to prepare solutions for two groups of problems from a cost accounting text [Horngren, 1982]. One group consisted of 20 problems which the students solved using a spreadsheet program on a microcomputer at the rate of two or three problems a week throughout the quarter. Students prepared solutions to the second group of problems over the whole quarter in the traditional way, with pencil, paper, and calculator. Problems for both spreadsheet and traditional solutions covered the topics of cost-volume-profit analysis, job and process costing, budgeting, cost allocation, and variance analysis. All the problems came from the text. For each topic, problems with the most lengthy calculations were selected for spreadsheet solution. The course content covered was equivalent to that of the previous year's course with the exception of the addition of microcomputer use.

During the winter quarter, students prepared a progressive solution to an integrated case [Clark, 1984] which covered budgeting, allocating service costs, process costing, developing standard costs, analyzing variances, and making general ledger entries. Each student received a copy of the case and machine-readable spreadsheet templates containing column and row headings for case solutions. In solving the case, students linked (1) cost allocation with overhead rate changes and (2) flexible budgets and equivalent unit computations with variance analysis. The case was designed so that each section built on previous sections, and students had to use output from one section as input to the remaining sections. When students changed input data in one section, results in subsequent sections changed accordingly. By the course's conclusion, students had prepared an integrated cost accounting system for the company described in the case. The length, comprehensiveness, and complexity of the case resulted in students needing to use a computer to prepare solutions in a reasonable time. As in the previous quarter, students also prepared solutions to other problems from the text in the traditional way. Problems solved the traditional way covered the same topics as in the previous quarter and were similarly spaced over the quarter.

Final examinations for all sections were comparable. All examinations had the same mix of objective questions and problems, which students solved with calculators. The final examinations were also comparable to examinations used in the course the previous year.

The Computing Environment

Most students had completed a sophomore-level computer programming course in FORTRAN, and many students had worked an accounting cycle practice set on a microcomputer. None of the students had experience with the specific microcomputer or spreadsheet program used in the course.

The instructor introduced students to using the spreadsheet on the microcomputer in the first two-hour laboratory session. Students spent two of every five class hours per week in the supervised laboratory, working at their own pace on assigned problems. During laboratory sessions, the instructor answered questions about the microcomputer, the spreadsheet program, and the accounting problems. On average, students required six hours of laboratory time to become proficient with spreadsheet use so they could work independently. The laboratory was available to students on an unsupervised basis in evenings and on weekends.

Method

If computer use promotes learning directly or makes learning easier by reducing the computational burden, then students should want to use computers in other situations and will generally view computer use as important to learning. An experiment to test this premise requires measuring student attitudes and perceptions before and after using a computer for

EXHIBIT 1
SURVEY OF STUDENTS' ATTITUDES

Question One Relating To Hypothesis One
(Included On Both Pre-test and Post-test)

The use of microcomputers for education: (Circle number that applies.)

5	4	3	2	1
Excites Me	Interests Me	I Am Indifferent	Bores Me	Completely Turns Me Off

Question Two Relating To Hypothesis Two
(Post-test Only)

Should the use of microcomputers be included in other accounting courses such as financial, auditing, or tax? (Circle number that applies.)

5	4	3	2	1
Definitely Should	Probably Should	Makes No Difference	Probably Should Not	Definitely Should Not

Question Three Relating To Hypothesis Three
(Post-test Only)

How has using a microcomputer in this course helped you in learning managerial accounting? (Circle number that applies.)

5	4	3	2	1
Made Learning A Lot Easier	Helped My Learning	Neither Helped Nor Hindered	Hindered My Learning	Made Learning A Lot Harder

learning. Changes in attitudes and perceptions can then be used to evaluate hypotheses regarding student perceptions of the effect of computer use on learning.

Pre- and post-test questionnaires were used to measure student attitudes and perceptions of microcomputer use in this study. Student grade point averages (GPA) were obtained from university records. In each section, students completed a pre-test questionnaire at the beginning of the course. The questionnaire was completed before the instructor explained the work students would do with the microcomputer. Students were told the purpose of the questionnaire was to elicit their opinions about the use of microcomputers and were assured their responses were confidential and independent of grades. Students were not informed about the existence or nature of the experiment.

The pre- and post-test questionnaires contained questions about attitudes toward and perceptions of using computers in accounting. Exhibit 1 presents these questions in the order the hypotheses are tested. Students marked a five-point

Likert-type scale for each question. The pre-test also collected the following demographics information: class standing and previous microcomputer and mainframe computing experience.

Significance Tests and Models

To determine if sample means for the following attitudinal variables were significantly different from the indifference point of the scale (a value of three on the five-point scale), *t*-tests were used:

Variable	*Explanation*
PRE/DES	Desire to use microcomputers before taking the course.
POS/DES	Desire to use microcomputers after taking the course.
OTHER	Desire to use microcomputers in other courses.
LEARN	How microcomputers helped learning.

A paired-comparisons *t*-test was used to determine whether the pre- and post-test desires to use microcomputers were significantly different. The variable DIF/DES is the difference between post- and pre-test desires, i.e., DIF/DES = (POS/DES − PRE/DES).

Fixed-effects analysis of covariance (ANOCOVA) models, implemented as general linear models[2] (GLM) across unbalanced cells, were used to determine sources of variation associated with attitudinal variables and the performance variable FINAL, the percent correct on the final examination. In each ANOCOVA, the independent variables were:

Variable	*Explanation*
GPA	grade point average, the covariate
TYPE	treatment: multiple problems or integrative case
SECT (TYPE)	section nested within treatment: sections 1, 3, and 4 correspond to instructor 1, and section 2, to instructor 2
MIEXP	microcomputer experience previously: yes or no
MAEXP	mainframe computer experience previously: yes or no
CLASS	junior, senior, or graduate student

A separate ANOCOVA was performed for each of the following dependent variables: DIF/DES, OTHER, LEARN, and FINAL. Except for the covariate GPA, all independent variables had fixed levels.

Least-squares means contrasts[3] in the ANOCOVA models were the basis for determining response differences attributable to treatment effects—many small problems or one integrative case.

EMPIRICAL RESULTS

The following sections explain the empirical results for each hypothesis.

Hypothesis One

Hypothesis One was designed to determine if microcomputer use induces productive thinking in which students are able to see specific applications as interrelated parts of a total problem structure. Evidence for evaluating this hypothesis comes from results of the ANOCOVAs for Hypotheses Three and Five in which TYPE was the only significant variable.

In the ANOCOVA for Hypothesis

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[2] A GLM model can compute least-squares estimates of marginal means, estimators of the class means that would have been expected had the design been balanced. The implementation used here was the SAS [1982] GLM procedure. Searle, Speed and Milliken [1980] explain the concept, the Freund and Littell [1981] describe its SAS implementation.

[3] A least-squares means contrast is a contrast based on marginal means for the effect or variable. Contrasts are linear functions in which the elements of the coefficient vector sum to zero for each effect. The *F* test due to a contrast tests the hypothesis that the linear function of effects is zero [SAS, 1982, p. 146].

TABLE 2

LEAST-SQUARES MEANS BY TREATMENT TYPE

Treatment Type	Least-Squares Means[1]	
	DIF/DES	LEARN
Problems	−1.02	3.43
Case	−1.96	3.95

[1] Least-squares means are estimators of the treatment marginal means that would be expected had the design been balanced [SAS, 1982, p. 148].

Three, the least-squares means (see Table 2) for the treatment effects for the difference DIF/DES between paired responses for the desire to use microcomputers before and after the course were:

Treatment	*Least Squares Means for DIF/DES = POS/DES − PRE/DES*
Many small problems	−1.02
One integrated case	−1.96
Difference in treatments	0.94

The positive difference of 0.94 between the two least-squares means for the two treatments indicates that students' desire to use microcomputers decreased less for those preparing many small problems than for those preparing the integrative case. The significance level of this contrast between treatments was 0.01. Given the small R^2 for the overall model (0.21 in Table 3, Panel A), the significance of TYPE implies some support for the first part of Hypothesis One, namely, that students prefer many small problems to one large, integrative case.

In the ANOCOVA for Hypothesis Five, the least-squares means (see Table 2) for the treatment effects for LEARN, how microcomputers helped learning, were:

Treatment	*Least-squares Means for LEARN*
Many small problems	3.43
One integrated case	3.95
Difference in treatments	−0.52

Students preparing the case thought they learned more than students preparing many small problems. The significance level of this contrast between treatments was 0.01. Given the small R^2 for the overall model (0.19 in Table 3, Panel C), the significance of TYPE implies some support for the second part of Hypothesis One, namely, that students perceive greater learning with one large, integrative case than with many small problems. Indeed, without use of the spreadsheet program, some students would not have been able to complete the integrative case. All students in the case treatment sections completed the case.

Hypothesis Two

The object of Hypothesis Two was to determine whether students preparing an integrative case performed better than students working on many small problems. The ANOCOVA model for FINAL had an F value of 4.17 with significance 0.01 and R^2 of 0.34.[4] As shown in Table 4, the covariate GPA and main effects MIEXP and MAEXP were significant at the 0.01, 0.08, and 0.05 levels, respectively. The interactions of GPA with MIEXP and

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[4] In the GLM, the sums of squares for each effect are adjusted for all other effects. The sums of squares are Type III, independent of cell frequencies and invariant to ordering of effects in the model [SAS, 1982, p. 165]. Type III sums of squares do not add to the model sum of squares.

TABLE 3
ANOCOVA OF STUDENT ATTITUDE

Panel A
Differences Between Desire to Use Microcomputers Before and After Course

	R^2	*DF*	*F*	*Significance of F*
Overall Model	0.21	91	2.82	0.01
Sources of Variation				
GPA		1	0.75	0.39
Type: problems or case		1	7.30	0.01
Section		2	1.87	0.16
Previous micro experience		1	0.72	0.40
Previous mainframe experience		1	0.93	0.34
Class standing		2	0.88	0.42

Panel B
Whether Microcomputers Should Be Used in Other Accounting Courses

	R^2	*DF*	*F*	*Significance of F*
Overall Model	0.09	91	1.08	0.38
Sources of Variation				
GPA		1	0.01	0.92
Type: problems or case		1	2.30	0.13
Section		2	2.52	0.09
Previous micro experience		1	0.07	0.79
Previous mainframe experience		1	0.00	0.99
Class standing		2	0.10	0.91

Panel C
Whether Microcomputers Helped Learning in This Course

	R^2	*DF*	*F*	*Significance of F*
Overall Model	0.19	91	2.46	0.02
Sources of Variation				
GPA		1	0.53	0.47
Type: problems or case		1	6.99	0.01
Section		2	0.63	0.53
Previous micro experience		1	0.07	0.79
Previous mainframe experience		1	0.43	0.51
Class standing		2	2.32	0.10

MAEXP were significant at the 0.05 and 0.09 levels, respectively. In a model with all first-order interactions, no other interactions were significant at the 0.10 level.

The lack of significance for TYPE means it is not possible to reject the null hypothesis of no performance difference attributable to treatment type—many small problems or one integrative case. The significance of the covariate GPA is a function of its high correlation with final examination scores. The significance of MIEXP and MAEXP suggests that performance effects of computer use are cumulative across all computer use, not just a function of the particular hardware/software use under study. Final examination performance was positively related

TABLE 4

ANOCOVA OF FINAL EXAMINATION PERFORMANCE

	R^2	DF	F	Significance of F
Overall Model	0.34	91	4.17	0.01
Sources of Variation				
GPA		1	17.86	0.01
Type: problems or case		1	0.39	0.53
Section		2	1.06	0.35
Previous micro experience		1	3.23	0.08
Previous mainframe experience		1	4.12	0.05
Class standing		2	1.44	0.24
GPA* micro experience		1	3.87	0.05
GPA* mainframe experience		1	2.89	0.09

to previous micro and mainframe computing experience. The significance of the GPA and computing experience interactions also supports the premise of a direct relationship between past and current performance and cumulative computer use.

Hypothesis Three

The objective of Hypothesis Three is to determine if, after using microcomputers, students want to continue using them. Table 5 shows that, based on a five-point scale, the mean response values for all students before (PRE/DES) and after (POS/DES) using the microcomputer were 4.35 and 2.92, respectively. Table 1 shows means by treatment and section.

As shown in Table 5, the pre-test mean response is significantly higher than the indifference point (*t*-value of 18.41 at significance level 0.01), indicating that students initially had a positive attitude toward using the microcomputer. The post-test mean, however, does not differ significantly from the indifference point (*t*-value of −0.49 at significance level 0.62). A paired-comparisons *t*-test for the pre-test and post-test attitudes—PRE/DES and POS/DES—gave a *t*-value of −8.55 (significant at the 0.01 level), indicating that the before and after mean response values were significantly different. The finding of a strong desire to use microcomputers before using them and indifference after using them was contrary to Hypothesis Three, suggesting that in this experiment microcomputer use did not increase student desire to use microcomputers more generally.

Possible sources of variation in the desire to use microcomputers besides the treatment effect are: previous academic achievement, previous experience with computing (microcomputer and mainframe), course section, and instructor. Previous academic achievement, represented by GPA, may influence student attitude toward computer use. Previous experience with computing might be important if the experience was sufficient for students to form a lasting opinion of the value of computers in their education. Class standing (junior, senior, or graduate student) might be important as a proxy for academic maturity. Course section and instructor might be important in capturing differences in instruction across sections.

The ANOCOVA model for DEF/DES had an *F* value of 2.82 with significance 0.01 and R^2 of 0.21. As shown in Panel A of Table 3, the only significant main effect was TYPE with significance 0.01.

TABLE 5

MEAN RESPONSE ACROSS ALL SECTIONS

Variable	Mean	Standard Deviation	t-Value[1]	Significance Level
PRE/DES	4.35	0.70	18.41	0.01
POS/DES	2.92	1.51	−0.49	0.62
OTHER	3.92	0.97	9.09	0.01
LEARN	3.41	0.89	4.44	0.01

[1] t-value for the mean response minus the indifference point of the five-point scale. For all variables, $N = 92$.

(This model with first-order interactions added had no significant interactions.) The implications of the significance of TYPE are discussed under the results for Hypothesis One. The lack of significance (except for TYPE) indicates that the change in student desire to use microcomputers in courses is unrelated to GPA, previous computer experience, or class standing.

The least-squares means contrast between instructors had an F value of 0.41 and a significance of 0.52 across sections 1 and 2, indicating no difference between the two instructors. One instructor taught both sections winter quarter (sections 3 and 4); for this reason, only fall quarter sections (sections 1 and 2) were included in this test.

A mitigating factor in the results for Hypothesis Three may have been the reliability of the microcomputers themselves. Since the microcomputers did not always perform as expected, students were occasionally frustrated by machine failures. The most troublesome aspect was occasional loss of files. Students probably did not expect equipment failures, and their occurrence might have prompted disillusionment about the usefulness of microcomputers. There was no control for equipment failure so it is unknown whether the machines used in the experiment were less reliable than other microcomputers.

Hypothesis Four

Question Two (see Exhibit 1) was designed to test Hypothesis Four. The mean response (Table 5) across all sections for student attitude toward whether microcomputers should be used in other courses (OTHER) after having used a microcomputer was 3.92. The t-value for determining if the mean response was equal to the indifference point was 9.09 with significance 0.01. Thus, students in these sections thought microcomputers should be used in other accounting courses after participating in the experiment.

The ANOCOVA for OTHER had an F value of 1.08 and a significance level 0.38. Panel B of Table 3 gives the results, insignificant for all variables. (This model with first-order interactions added had no significant interactions.) Therefore, whether students think microcomputers should be used in other accounting courses does not depend upon GPA, previous computer experience, or class standing. Further, differences in instruction across sections and instructors did not affect responses.

Hypothesis Five

The mean response for whether students thought microcomputer use helped them learn managerial/cost accounting (LEARN) across all cells was 3.41 (Table 5). The t-value for testing the hypothesis that the population mean was the indifference point of the scale was 4.44 with significance 0.01. Thus, students across all sections thought microcomputer use helped them learn managerial/cost accounting.

The ANOCOVA model for LEARN had an F value of 2.46 and a significance level 0.02 with R^2 of 0.19. Panel C of Table 3 presents the results, insignificant for all variables except TYPE. (This model with first-order interactions added had no significant interactions.) The implications of the significance of TYPE are discussed under the results for Hypothesis One.

Limitations

Administrative and scheduling constraints precluded random assignment of students and instructors to sections. The correspondence of treatments to quarters, however, eliminated the opportunity for students to self-select treatments within a quarter. Even though the managerial/cost course is not part of a multi-course sequence, students were constrained in scheduling the course to fit schedules dominated by multi-course sequences. Consequently, it was unlikely that students dropped the course so they could take it later with a different treatment. Nesting of treatment type within quarter makes it impossible, however, to dispel all doubt about the comparability of fall and winter quarters.

This study was limited to use of one spreadsheet program with one vendor's microcomputer. Using microcomputers and software with varying degrees of ease of use and failure rates might give different results.

This study incorporated traditional problems and one case. The problems were not prepared specifically for solution with a spreadsheet program, and it would be infeasible for students to have prepared the case without using a spreadsheet program. Hence the problems and the case may have presented different learning stimuli, the differential learning effects of which cannot be measured with a final examination students complete in the traditional way—with pencil, paper, and calculator. For both traditional problems and the case, the learning difficulty was compounded by the students' learning spreadsheet use simultaneously with managerial/cost accounting.

CONCLUSIONS

The introduction of microcomputer use is a major change in accounting education and therefore merits thoughtful consideration. The objective of this research was to provide information for evaluating this change in educational practice. Five hypotheses were tested to determine (1) student attitude toward using a microcomputer spreadsheet program in a managerial/cost accounting course and (2) performance differences across two treatments—integrative and nonintegrative assignments. Results of this experiment revealed that students initially had strong desire to use microcomputers, but that their enthusiasm diminished after the experiment. Factors which likely contributed to this decrease were frustration accompanying machine failures, start-up efforts of developing microcomputer skill, and satiation of curiosity about microcomputers. The effect of these factors should, however, diminish over time as machine reliability improves and computer use increases at all educational levels.[5]

Though student desire to use computers decreased in this experiment, students indicated computers should be used in other accounting courses. They reported that microcomputer use helped them learn managerial/cost accounting. Students preparing the integrative case thought microcomputer use helped them learn more than students preparing many small problems. Although there was no performance difference across treatment types, performance was positively related to previous computing experience.

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[5] The National Council of Teachers of Mathematics proposed a plan for incorporating computing technology into elementary and secondary education in its report, "The Impact of Computing Technology on School Mathematics" [December 1984].

Viewed collectively, results for the five hypotheses support the proposition that microcomputer use is a positive pedagogical technique. The effectiveness of microcomputer use, however, may not be as dramatic as one would have expected. The results of this research are similar to those reported by Kulik, Kulik and Cohen [1980] described earlier. Microcomputer use had small but real effects on student perceptions of their learning of accounting but no effect on performance on the final examination. Accounting educators should recognize that the initial effect of computer use may not meet their expectations. Accounting educators should not expect microcomputers to have immediate and dramatic effects when used in only one course. A significant impact may be apparent only after computer use is integrated throughout the accounting curriculum.

While it does not address integration on a curriculum-wide basis, the present study provides information regarding use of microcomputing in one course. The students in this experiment reported they experienced greater learning with integrative course material than with repetitive, non-integrative assignments. This finding suggests that a benefit of computer use in learning may be the opportunity it offers for productive thinking, that is, problem solving based on understanding rather than memorization.

The results of this study also imply that not all microcomputer applications or course integration strategies will have the same perceived learning value to students. It is important, therefore, that instructors be flexible in their approach and strive to develop more effective pedagogical techniques. In the final analysis, the payoff from computer integration must be greater student learning.

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Factors Contributing to Published Research by Accounting Faculties

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ABSTRACT: Little empirical research exists concerning the factors most conducive to research and publication activity by academic accountants. Thus, the basic question addressed by this study is: In the academic accounting community, what are the predominant characteristics of the "research environment" associated with publication activity? Responses by 208 academic accountants to a mailed questionnaire indicate the overall perception that access to the computer and two other categories of research facilitators are particularly important. Those categories are time-related items (reduced teaching loads and committee assignments) and people-related items (abilities/quality of fellow faculty members and graduate students). Employers are perceived by respondents as providing/supporting people-related items the best, access to the computer next, and time-related items the least. Responses are analyzed in terms of doctoral-granting programs, divided into two groups, and nondoctoral-granting programs. Results based on alternative grouping schemes are also reported.

RESEARCH and publication are generally accepted as important in the development and reputation enhancement of any academic discipline, including the academic arm of the accounting profession. Several years ago, Davidson [1957, p. 117] observed:

> The effectiveness or efficiency of a faculty is indeed difficult to measure, and I would not deny the important faculty function performed by the non-writing researcher. However, I think he is likely to be a relative "rare bird." For the great majority of faculty members, it seems to me that we must continue to emphasize the place of research and publication in their programs. Only by this procedure can we hope to have accounting remain a vital and stimulating force in business education and management.

This observation predates the current accounting research environment, but it still reflects the generally prevailing attitude in today's academic accounting community.

In spite of this emphasis, however, scant empirical research is available about the factors most conducive to research and publication activities by academic accountants. To date, research studies related to this area have concentrated primarily on identifying the schools most active in research and publication and

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have attempted to "rank" such schools (accounting programs) on this basis.[1] These studies provide insight into which accounting programs are *most productive* in published research, but they do not attempt to specify which research environmental factors give rise to (or are at least highly correlated with) such productivity.

To examine these issues, we mailed a questionnaire to a sample of 840 accounting faculty members listed in the 1983 Prentice-Hall *Accounting Faculty Directory* [Hasselback, 1983]. The questionnaire collected five types of information from respondents: their perceptions of research facilitators and reward systems as well as information about research support, demographic information about the respondents, and information about their recent publication activities.

This study is expected to aid accounting departments/schools in assessing the current environment provided for research and publication activities. We do not deny that individual ability and motivation are important factors in producing research. However, the research productivity of an individual can be frustrated or enhanced by his or her environment. What researchers perceive to be important facilitators, how well their programs are perceived to support these facilitators, and how these perceptions differ across schools with varying research environments are the primary topics of this paper.

METHOD

Questionnaire Design

Data for this analysis were collected in late spring and early summer 1983 via a mailed questionnaire consisting of five sections. The items/questions in sections one through three of the questionnaire were selected by the authors, in consultation with colleagues, as being representative of commonly perceived facilitators, reward systems, and support items for accounting research. A draft of the questionnaire was pilot-tested using colleagues at two universities. The questionnaire design and content also were reviewed by the Capstone Poll, a telephone and mail survey organization at the University of Alabama. The final design and content of the questionnaire resulted from input from these screenings.

The first section, "Research Facilitators," consisted of the 20 listed items shown in Table 3. Respondents were asked to give two responses for each of the listed items: first, to evaluate each item in terms of its relative importance to them for performing successful (published) research; second, to compare the accounting program/department in which they were currently employed to an "average" program in terms of facilitating (providing, supporting) each listed item for research purposes.

A subject-centered, relative-comparison response scale was used in this first section.[2] For the first response, the item "library holdings" was chosen as an "anchor item" and assigned a relative importance value of 100. Respondents then compared the other listed items to library holdings in terms of their relative importance to the respondent as research facilitators. For example, if the respondent perceived a listed item to be half as important as library holdings as a research facilitator, the item was to be assigned a value of 50; if perceived to be twice as important, it was to be assigned a value of 200. For the second response, the "average" program was assigned a value of 100 and the respondent compared his/her perception of his/her present employer with the anchor item.[3] For both responses, it was indicated that the respondent could assign any relative score—whole numbers, fractions, etc,—perceived to be appropriate.

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[1] Examples of this type of research include Bazley and Nikolai [1975], Andrews and McKenzie [1978], Windal [1981], and Bublitz and Kee [1984].

[2] See Howard [1981] and Howard and Nikolai [1983]. This response scale, rather than being merely respondent-centered, permits evaluation of *both* the stimuli and the respondent. Moreover, ratio level responses permit more rigorous statistical analysis of the data.

The second section of the questionnaire, "Reward System," asked the respondents to evaluate five listed activities—published research, teaching effectiveness, service activities (to school, community, profession, administration, etc.), political skill, and other (to be described by the respondent)—in reference to the respondent's perception of their importance at his/her present employer for 1) promotion, 2) tenure, and 3) salary increases. For each of the three responses requested, a subject-centered response scale was again used. Service activities was the anchor item and was assigned a value of 100.

The third section of the questionnaire, "Research Support," listed a number of items in question form that we perceive to be critical in facilitating research endeavors. The items covered such areas as number of course preparations, hours taught per week, and average number of students per class. Respondents were asked to answer the questions in terms of the accounting programs in which they were currently employed. This section provides evidence for actual comparisons of research support among the various schools, whereas the first section only recorded respondents' perceptions of research support.

The fourth section of the questionnaire collected demographic information from respondents and is summarized in Table 2. The last section of the questionnaire, "Published Research," listed 69 accounting, business, or related journals and asked respondents to indicate how many articles they had published (including acceptances) in those journals since January 1, 1976 (either alone or coauthored).[4] Results from this section are used as a measure of a respondent's research performance.

Sample and Response Rate

The questionnaire was mailed to a nonrandom sample of 840 accounting faculty members listed in the 1983 Prentice-Hall *Accounting Faculty Directory*. To be included in the sample, the faculty member must have received a terminal research degree (Ph.D., DBA, etc.) during the period of 1965–1980 and be currently employed in an accounting program offering a doctorate *or* an accounting program having at least ten faculty members with terminal degrees.[5] The last criterion was employed to cover nondoctorate-granting accounting programs large enough to emphasize and support research. These criteria targeted contemporary accounting academicians with at least two years full-time experience since receiving their degrees.

Over a period of two-and-one-half

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[3] Respondents were requested to compare their programs' support of a listed research facilitator with *their perceptions* of an average program's support of the item. No attempt was made in the questionnaire to define an "average" program. Because many different accounting programs were represented in the sample, we felt that requesting comparison of respondents' programs to their perceptions of an average program was more appropriate than an attempted definition of such a program. Some respondents questioned this lack of definition, but the vast majority did not appear to have (or at least did not indicate having) difficulties on this point. The third section of the questionnaire included more objective measures of actual research support at the respondent's place of employment.

[4] Additional spaces were provided for the insertion of other journals.

[5] The two accounting programs used in pretesting the questionnaire were eliminated from sample consideration. Also, faculty chairpersons, although considered in the count of faculty members with terminal degrees, were not mailed questionnaires because it was believed that their responses to certain items might be too favorably biased toward their own programs. Other than for the omission of pretest schools, at least one faculty member from each of the doctoral-granting programs listed in Hasselback [1983] was included in the sample.

months,[6] 208 usable questionnaires were returned for an overall usable response rate of 24.8 percent.[7] Because of the large nonresponse rate, we examined the data for nonresponse bias by comparing the responses received during the first week (47 responses) with those received during the last month (40 responses). The basis for this nonresponse test is the view that late respondents may be considered somewhat similar to nonrespondents.[8] A MANOVA test was performed between these two groups, with the variables of section one used as the dependent variables. The hypothesis that the two samples came from populations with the same parameters was not rejected at any reasonable level of confidence.[9]

SURVEY RESULTS

Each of the questionnaires was coded to indicate the accounting program employing the respondent. No effort was made to identify individual respondents other than for second-mailing purposes. Based on accounting program identification codes, the 208 questionnaires were divided into three groups believed to differentiate the research emphases of these programs.

First, all respondents from programs not offering doctoral degrees were identified. This classification was based on the assumption that *most* of these programs primarily emphasize teaching and related responsibilities. A total of 69 responses representing 33 programs (an average of 2.10 per program) fell into this category and are hereafter identified as Group 3. The remaining 139 responses from doctoral-granting programs were divided into two groups based on publication records of these programs as compiled in a study done by Bublitz and Kee (BK) [1984]. Top publishing programs were considered by BK to be those that ranked high in terms of publications in academically oriented journals.[10] A total of 67 responses representing 22 doctoral-granting programs (an average of 3.05 per program) fell into this category and are hereafter identified as Group 1. The remaining 72 responses, representing 33 doctoral-granting programs (an average of 2.18 per program), are hereafter identified as Group 2. Programs represented in this latter group are viewed as having research emphases somewhere between those of programs represented in Groups 1 and 3.

The questionnaire provides sufficient data to group the respondents in many ways. Our primary purpose in grouping the respondents is to determine if their perceptions were affected by the type of academic environment of their employer. The three groups used to categorize the schools serve as the basis for the primary analysis in this paper. Because we perceive interest in other criteria, two alternative groupings of these same respondents also are presented.

One scheme simply divides respondents, regardless of employer, into groups based on academic rank—assistant, associate, and full. The purpose of this grouping is to investigate whether academic rank influences perceptions of important research facilitators and employer provision/support of these facilitators. Although this grouping was originally in-

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[6] This period included a second request mailed one month after the first mailing to those not responding to the first mailing.

[7] In addition, 15 other questionnaires were returned but for various reasons could not be used.

[8] For a discussion of the early-late nonresponse bias testing approach, see Buzby and Falk [1979, pp. 27–28].

[9] The Wilks' criterion produced an $F_{39,34}$ statistic of 1.07 which is only significant at the .426 level. In addition, a percentage response analysis was performed on responses by certain groups identified in the sample. The grouping scheme used and the results of this analysis are discussed in subsequent sections.

[10] Specifically, schools were ranked based on the number of articles published in "academic" and "academic-practitioner" journals. For an explanation of these journal categories, see Bublitz and Kee [1984].

TABLE 1

RESPONDENT PUBLICATION AVERAGES

*Respondent Publication Averages for Groups Based on Schools**
in Total and by Journal Category
(Since January 1, 1976)

	Total	*Academic*	*Academic Practitioner*	*Practitioner*			*Number of Respondents*
				Public	*Private*	*Tax*	
Doctoral-Granting Programs							
Group 1	8.46	2.71	1.98	1.26	1.66	.85	62
Group 2	7.09	.75	1.04	1.96	2.49	.85	67
Nondoctoral-Granting Programs							
Group 3	7.38	.50	.98	2.31	2.27	1.32	62
Total responses							191
No responses**							17
Total sample							208

*Respondent Publication Averages for Groups Based on Academic Rank**
in Total and by Journal Category
(since January 1, 1976)

	Total	*Academic*	*Academic Practitioner*	*Practitioner*			*Number of Respondents*
				Public	*Private*	*Tax*	
Assistant	3.78	.78	.83	.50	1.11	.56	36
Associate	7.64	1.13	1.28	1.87	2.30	1.06	82
Full	9.51	1.75	1.63	2.48	2.49	1.16	73
Total responses							191
No responses**							17
Total sample							208

Respondent Publication Averages for Groups Based on Individual Publication Records
in Total and by Journal Category
(since January 1, 1976)

	Total	*Academic*	*Academic Practitioner*	*Practitioner*			*Number of Respondents*
				Public	*Private*	*Tax*	
High	12.41	3.34	3.03	2.92	2.48	.62	64
Middle	5.66	.55	.94	1.47	1.75	.95	64
Low	4.79	.00	.00	1.13	2.22	1.44	63
Total responses							191
No responses**							17
Total sample							208

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* Based on a two-way MANOVA with the individual's publications in each of the five journal categories as the dependent variable, the three groups based on the individual's school are significantly different at the 0.00001 level, but the three academic ranks are only significantly different at the .1178 level. In both cases the F-statistic is based on Wilks' criterion.

** This category includes those who filled out all the questionnaire except section 5 on their publication record.

troduced as a control variable, the results proved sufficiently interesting to disclose here.

A second grouping scheme used in lieu of the employer variable is based on each individual's publication record instead of the record of his employer. Based on responses to section 5 of the questionnaire, an average number of publications per respondent in the academically oriented journals discussed above was computed. The respondents were then ranked by their average publication record and grouped into three approximately equal categories.[11] The "low" group had *no publications* in the academically oriented journals. The remaining respondents were divided into "high" and "middle" categories, depending on whether they were in the upper or lower half of the distribution of average publication rates. The purpose of this grouping is to investigate differences in respondents' perceptions based on their own publication productivity rather than that of different academic environments.

Group Publication Records

For comparative purposes, Table 1 summarizes the number of individuals in each grouping scheme and subgroups as well as publication results for each group. Publications on an average per-group-respondent basis are presented along with a breakdown as to journal categories in which the publications appeared. As the note in Table 1 indicates, the first grouping scheme significantly differentiates among respondents employed by schools with different publication emphases. No such test statistic was applied to the third grouping scheme because it was derived from differences in respondent publications.

Demographic Characteristics

Table 2 lists some demographic characteristics for total responses and for each of the three groups in the primary grouping scheme. The percentages reported in the first part of Table 2 seem to indicate that full professors are slightly overrepresented in the respondents—especially in Group 1—and assistant professors are slightly underrepresented—especially in Group 3. Otherwise, responses by category are all in the 20 to 30 percent range. Although the average age of all respondents is approximately 40, Group 3 respondents are slightly older, on average, as would be expected, given the larger number of associate and full professors in this group compared to Groups 1 and 2 (61 versus 51 and 50, respectively, in each of the latter two groups).

Research Facilitators

Table 3 summarizes responses to the "Research Facilitators" portion of the questionnaire for groups determined by place of employment. The first four columns of Table 3 provide average responses and rankings of these means for each group and in total as to which facilitators are perceived by the respondents to be the most important for performing successful (published) research. The item library holdings is given a value of 100 as a reference point. Across-group mean differences that are significant (at 0.05 or 0.10) are also indicated for this part of Table 3. The last four columns of Table 3 provide average responses and rankings of these means for each group and in total, and give respondents' perceptions of how well the accounting programs employing them are providing/supporting each research facilitator in comparison with an average program. The average program is given a value of 100 as a reference point.[12] The

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[11] See Bublitz and Kee [1984] for a discussion of journal categories. Average number of publications per respondent was determined by dividing publications indicated by either seven (section 5 only requests the number of publications since 1976) or the number of years since the respondent received his/her doctorate, whichever is less.

[12] The reader is cautioned against comparing total and group relative response values for individual items in the

TABLE 2
DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS TO SURVEY QUESTIONNAIRE GROUPS DETERMINED BY SCHOOL

	Response Rates													
	Group 1				*Group 2*					*Group 3*				
	Assistant	*Associate*	*Full*	*Total*	*Assistant*	*Associate*	*Full*	*No Reply*	*Total*	*Assistant*	*Associate*	*Full*	*Total*	*Totals*
Number in sample	79	104	74	257	57	125	80	—	262	44	139	138	321	840
Number responding	16	23	28	67	16	35	20	1	72	8	29	32	69	208
Percentage response	20.3%	22.1%	37.8%	26.1%	28.1%	28.0%	25.0%		27.5%	18.2%	20.9%	23.2%	21.5%	24.8%

Other Demographic Characteristics

	Group 1	*Group 2*	*Group 3*	*Total*
Average years				
—since receiving doctorate	10.2	8.2	9.8	9.4
—at current employer	8.0	6.6	7.3	7.3
Those with tenure				
number	47	46	50	143
percentage	70.2%	64.8%	72.5%	68.8%
Average age	39.7	40.0	42.1	40.6

correlation coefficients beneath the last four columns of Table 3 show the correlations between average relative importance and employer facilitation responses and between item rankings for the two responses.[13]

To see if differences exist across groups, a MANOVA statistical test was performed using all the variables of section 1 as dependent variables and the three groups of respondents as independent variables. The hypothesis that the three centroids are equal was rejected at the 0.0002 confidence level ($F_{18,256} = 1.86$).[14]

Because the distribution of academic ranks (assistant, associate, and full professors) differed among the three groups (see Table 2), a two-way MANOVA was computed using these three academic ranks as additional independent variables. The 19 variables representing the importance of each facilitator and the 20 variables representing the relative resources of the employer were successively used as the dependent variables. The results for each of the MANOVAs are summarized in the top portion of Table 4.[15] Even controlling for rank, the group effect is significant for both sets of dependent variables and for several of the variables individually as indicated in Table 3. This test lends additional credence to the grouping technique adopted here—i.e., the average perceptions of these three groups are likely to be different.

Relative Importance

The research facilitators in Table 3 are ranked in order from one to 20 based on their overall average *relative importance* values to the respondents. Although there are differences across groups for individual items on the list, overall the top five research facilitators would seem to distinguish themselves from the rest because several numbers bunch together below the 141 level.[16] These five facilitators are reduced teaching load (overall rank of one based on average relative importance value of 194), access to the computer (2; 190), research abilities of fellow faculty members (3; 173), high quality graduate students (4; 162), and reduced number of committee assignments (5; 152).

Freeing time for conducting research projects is an important facilitator across all three groups, as evidenced by the high relative values and rankings attached to reduced teaching loads and reduced committee assignments. However, it is also clear that Group 2 attaches a lower relative importance to reduced teaching load than do Groups 1 and 3. The high ranking given to access to computer as a facilitator could be expected, given the emergence of computer use in accounting research over the last two decades. Group 1 placed it particularly high in relative importance. Another computer-related item, access to computer data bases, ranked in the top six for both Groups 1 and 2 but was so lowly ranked by Group 3 that it placed 11th overall. Access to the compu-

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first four columns to those in the last four columns because of differing anchor items.

[13] Top-end responses deemed to be "outliers" were truncated at 2,500 (25 times the anchor item value of 100) for the analyses reflected in Tables 3, 4, 5, 6, and 7.

[14] However, a plot of the variables indicated that many of them deviated greatly from a normal distribution. After trying several transformations, a log transformation was chosen to bring the distributions closer to normal. The MANOVA results were not changed, however. Results based both on truncation at 2500 and the log transformation are given in Table 4.

[15] In each case, if any one of the variables is missing, the entire observation is excluded. The significance of the MANOVAs was determined using Wilks' criterion. See Tatsuoka [1971, pp. 197–206].

[16] Kendall's Coefficient of Concordance (see Hays [1973, pp. 801–3]) was used to test for the degree of concordance across the ranks of all three groups for each of the perceptions in Table 3 (and Tables 5 and 6 as well). Whether perceptions of research facilitators involved importance to research or provision/support of employer, and regardless of the grouping scheme used, facilitator ranks were significantly "concordant" (at 0.005) across all three groups.

TABLE 3

MEAN RESPONSES ON RESEARCH FACILITATORS FOR GROUPS DETERMINED BY SCHOOL
(THE RANKING OF FACILITATORS IS GIVEN IN PARENTHESES)

Research Facilitators	*Relative Importance to Research (library holdings = 100)*				*Relative Provision/Support of Employer (average program = 100)*			
	Group				*Group*			
	1	*2*	*3*	*Total*	*1*	*2*	*3*	*Total*
Reduced teaching load*	210(3)	155(3)	220(1)	194(1)	136(14)	113(13)	88(14)	112(13)
Access to computer**	228(1)	177(1)	166(4)	190(2)	212(3)	161(1)	135(1)	169(2)
Research abilities of your fellow faculty**	223(2)	160(2)	138(9)	173(3)	264(1)	151(3)	103(8)	170(1)
High quality of graduate students	168(4)	151(4)	166(4)	162(4)	192(6)	126(7)	104(7)	139(6)
Reduced number of committee assignments	161(5)	136(7)	161(6)	152(5)	135(15)	126(7)	91(12)	117(12)
Compensation above your base pay from funds generated within your university**	128(11)	120(15)	174(2)	141(6)	124(18)	84(19)	78(18)	94(19)
Research assistants provided by school	150(7)	137(6)	131(13)	139(7)	137(13)	124(9)	70(20)	110(15)
Typing support	140(8)	132(8)	138(8)	137(8)	146(12)	115(12)	108(5)	122(11)
Funding for research assistants, supplies . . .	138(9)	132(8)	139(7)	136(9)	131(16)	101(16)	77(19)	102(17)
Compensation above your base pay from funds generated outside your university**	126(12)	116(17)	166(4)	136(9)	129(17)	80(20)	86(15)	97(18)
Access to computer-based data banks	152(6)	139(5)	102(17)	131(11)	184(8)	119(10)	81(17)	127(8)

TABLE 3—(*Continued*)

Research Facilitators	*Relative Importance to Research (library holdings = 100)*				*Relative Provision/Support of Employer (average program = 100)*			
	Group				*Group*			
	1	*2*	*3*	*Total*	*1*	*2*	*3*	*Total*
Access to computer consulting for assistance with research projects	123(15)	131(10)	136(11)	130(12)	163(9)	117(11)	100(9)	126(9)
Opportunity to teach graduate courses	132(10)	126(11)	132(12)	130(12)	203(4)	154(2)	123(2)	159(3)
Travel support	124(14)	124(12)	137(10)	128(14)	151(10)	131(6)	107(6)	129(7)
High quality of undergraduate students	115(16)	122(14)	116(16)	118(15)	202(5)	132(5)	118(4)	149(5)
Access to statistical consulting for assistance with research projects	104(17)	124(12)	117(15)	115(16)	148(11)	99(17)	92(11)	112(13)
Research record of the school at which you are employed*	125(13)	117(16)	90(20)	111(17)	250(2)	134(4)	93(10)	156(4)
Library holdings	100(18)	100(18)	100(18)	100(18)	186(7)	110(15)	89(13)	126(9)
Consulting activities*	85(20)	73(20)	126(14)	94(19)	92(20)	113(13)	121(3)	109(16)
Other clerical support	92(19)	82(19)	94(19)	89(20)	110(19)	86(18)	84(16)	93(20)
Correlation between average importance to research and provision/support of employer	Pearson				.4475	.5481	.0376	.3284
	Spearman Rho				.3263	.4932	.0075	.1743

* Importance to research significant at .05 level.
** Importance to research significant at .10 level.

TABLE 4
SIGNIFICANCE OF DIFFERENCES IN RESEARCH FACILITATORS

Groups Based on Schools
Log Adjusted Data

Item	*Importance to Research (196)***			*Provision/Support of Employer (177)***		
Significance of Sample Size	*Group*	*Rank**	*Interaction*	*Group*	*Rank**	*Interaction*
Overall MANOVA	.0152	.0109	.6704	.0001	.1532	.8604

Groups Based on Individual Publications
Log Adjusted Data

Item	*Importance to Research (180)***			*Provision/Support of Employer (161)***		
Significance of Sample Size	*Group*	*Rank**	*Interaction*	*Group*	*Rank**	*Interaction*
Overall MANOVA	.0619	.0014	.0565	.3825	.1878	.0987

* Assistant, associate, or full professor
** Sample size
Note: To avoid extreme positive skewness, all responses over 2500 were truncated at 2500 before the log transformation. The result of the transformation varied for different variables but most variables showed no or slightly negative skewness and kurtosis measures near 3.

ter also ranked lower in Group 3 than in the other groups, probably because the high level of practitioner research documented for this group requires less use of computer resources.

The fact that high quality graduate students were consistently considered to be important research facilitators could be anticipated for Groups 1 and 2 accounting programs, but the Group 3 response is somewhat surprising, given that graduate students in these programs are not at the doctoral level.[17] Groups 1 and 2 respondents (especially those in Group 1) gave higher relative importance to the research abilities of their fellow faculty members than did Group 3 respondents. Apparently in the more research-oriented programs, colleagues with a research orientation are viewed as being important in terms of providing both ideas for and constructive criticisms of research projects.[18] Moreover, such colleagues also provide the opportunity for conducting joint research projects.

Somewhat surprisingly, additional compensation items, both internal and external, did not make the top five ranking overall.[19] However, responses clearly indicate that Group 3 considers additional compensation to be highly important as a research facilitator, more so than any other factor except reduced teaching loads. Although this study did not collect data on respondent salaries, one might believe that on average doctoral-granting programs (Groups 1 and 2) provide higher compensation to faculty.

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[17] The fact that the item "high quality undergraduate students" ranks so low in relative importance for all groups may imply that the undergraduate curriculum, with its emphasis on practice, adds little to the academic research environment.

[18] Several respondents mentioned that a research facilitator that should have been included in the questionnaire was an "accounting workshop" series in which research projects are presented and discussed. In retrospect, our guess is that had such a facilitator been listed, it would have been ranked highly, especially in Groups 1 and 2.

[19] "Additional compensation" items were listed in the questionnaire as "compensation above your base salary from funds generated within (outside) your university." A condensed description is used in the discussion in this paper.

Employer Facilitation

The last four columns in Table 3 indicate that respondents *overall* feel that their programs are as good as or better than the "average" program in providing/supporting most of the research facilitators listed. As expected, large differences exist across groups in terms of employer facilitation values and attendant rankings. Group 1 respondents had an average employer facilitation value of less than 100 for only one item, Group 2 for four items, and Group 3 for 11 items. Clearly, then, the perception of employer provision/support of the research facilitators listed *vis-a-vis* an average program is highest for Groups 1 and 2 and lowest for Group 3.

The more important issue, however, is how well accounting programs were perceived to provide/support those research facilitators higher in relative importance. Table 3 lists the research facilitators in order of their relative importance for easy comparisons on this point. Also, the correlation coefficients at the bottoms of the last four columns in Table 3 provide first, correlations between average relative importance values for research and average employer facilitation values and second, the comparable Spearman Rho rank correlations. Both sets of correlation coefficients are not very high for any one group or on an overall basis, although this low correlation is less apparent for Group 2, more apparent for Group 1, and most apparent for Group 3.

For only the top five research facilitators in terms of relative importance, the employer facilitation record is not quite as inadequate, at least for Groups 1 and 2, as the overall correlation coefficients might imply. All five items are perceived by respondents *overall* to be better supported/provided by employers than the average program. Only Group 3 respondents felt their programs offered support below the average program for any of the items (two below 100).

It seems clear that many of the research facilitators accounting programs are perceived to provide/support well are perceived to be relatively unimportant for conducting research; hence the low correlation between the "totals" columns in Table 3. The most obvious of these are opportunity to teach graduate courses, travel support, high quality undergraduate students, and research record of school of employment. However, an explanation may be that respondents rank as more important those resources they believe they do not have—i.e., at the margin, these resources are more important. The opportunity to teach graduate courses, especially at Group 1 and 2 programs, would appear to be a good example. The opportunity is readily available—Provision/Support of Employer responses—and may not be perceived as highly important to research for this reason.

Alternative Analyses

Table 3 summarizes results based on environmental groupings of respondents. Two alternative grouping schemes are presented for comparative purposes. These are groups determined by academic rank (Table 5) and groups determined by individual publication count (Table 6). Tables 5 and 6 are otherwise formatted and analyzed in the same ways as Table 3.

For both relative importance to research and relative provision/support of employers, the alternative analyses generally raise the degree of concordance across group ranks. For example, in

TABLE 5

MEAN RESPONSES ON RESEARCH FACILITATORS FOR GROUPS DETERMINED BY ACADEMIC RANKS
(THE RANKING OF FACILITATORS IS GIVEN IN PARENTHESES)

	Relative Importance to Research (library holdings = 100)				*Relative Provision/Support of Employer (average program = 100)*			
	Group				*Group*			
Research Facilitators	*Assistant*	*Associate*	*Full*	*Total*	*Assistant*	*Associate*	*Full*	*Total*
Reduced teaching load	249(1)	167(2)	194(1)	194(1)	126(12)	109(15)	107(14)	112(13)
Access to computer*	233(2)	202(1)	156(4)	190(2)	161(6)	187(1)	152(5)	169(2)
Research abilities of your fellow faculty**	220(3)	163(3)	161(3)	173(3)	214(1)	162(2)	157(3)	170(1)
High quality of graduate students	186(4)	150(4)	162(2)	162(4)	176(4)	126(8)	135(7)	139(6)
Reduced number of committee assignments	166(5)	149(5)	149(5)	152(5)	132(8)	129(7)	96(18)	117(12)
Compensation above your base pay from funds generated within your university	133(15)	142(6)	144(6)	141(6)	89(18)	101(17)	89(20)	94(19)
Research assistants provided by school	151(10)	131(8)	142(9)	139(7)	95(16)	117(12)	109(13)	110(15)
Typing support*	162(7)	122(12)	140(10)	137(8)	129(11)	119(11)	123(11)	122(11)
Funding for research assistants, supplies . . .	157(8)	128(10)	135(11)	136(9)	109(15)	100(18)	102(15)	102(17)
Compensation above your base pay from funds generated outside your university	136(13)	130(9)	143(8)	136(9)	122(14)	90(19)	92(19)	97(18)
Access to computer-based data banks	124(16)	141(7)	123(13)	131(11)	130(10)	125(10)	128(9)	127(8)

TABLE 5—(*Continued*)

Research Facilitators	*Relative Importance to Research (library holdings = 100)*				*Relative Provision/Support of Employer (average program = 100)*			
	Group				*Group*			
	Assis-tant	*Asso-ciate*	*Full*	*Total*	*Assis-tant*	*Asso-ciate*	*Full*	*Total*
Access to computer consulting for assistance with research projects	164(6)	123(11)	121(14)	130(12)	94(17)	132(5)	135(7)	126(9)
Opportunity to teach graduate courses*	154(9)	106(17)	144(6)	130(12)	173(5)	153(3)	159(1)	159(3)
Travel support	137(12)	122(12)	131(12)	128(14)	140(7)	130(6)	122(12)	129(7)
High quality of undergraduate students	150(11)	108(16)	112(15)	118(15)	182(2)	126(8)	158(2)	149(5)
Access to statistical consulting for assistance with research projects	119(17)	117(14)	111(16)	115(16)	87(19)	112(14)	124(10)	112(13)
Research record of the school at which you are employed	135(14)	111(15)	97(19)	111(17)	177(3)	149(4)	154(4)	156(4)
Library holdings	100(19)	100(18)	100(17)	100(18)	131(9)	115(13)	135(7)	126(9)
Consulting activities	100(19)	89(19)	98(18)	94(19)	125(13)	109(15)	101(17)	109(16)
Other clerical support**	103(18)	77(20)	96(20)	89(20)	80(20)	90(19)	102(15)	93(20)
Correlation between average importance to research and provision/support of employer			Pearson		.4383	.5049	−.0730	.3284
			Spearman Rho		.3821	.2327	−.0181	.1743

* Importance to research significant at .05 level.
** Importance to research significant at .10 level.

TABLE 6

MEAN RESPONSES ON RESEARCH FACILITATORS FOR GROUPS DETERMINED BY PUBLICATION COUNT
(THE RANKING OF FACILITATORS IS GIVEN IN PARENTHESES)

Research Facilitators	*Relative Importance to Research (library holdings = 100)*				*Relative Provision/Support of Employer (average program = 100)*			
	Group				*Group*			
	High	*Middle*	*Low*	*Total*	*High*	*Middle*	*Low*	*Total*
Reduced teaching load	192(3)	178(1)	202(1)	190(1)	137(13)	105(16)	88(15)	110(16)
Access to computer**	269(1)	158(3)	141(5)	190(1)	240(2)	149(1)	128(2)	172(1)
Research abilities of your fellow faculty*	222(2)	165(2)	128(12)	172(3)	243(1)	147(2)	127(3)	171(2)
High quality of graduate students	168(5)	154(4)	158(2)	160(4)	178(6)	122(9)	120(5)	140(6)
Reduced number of committee assignments	154(6)	147(6)	151(3)	151(5)	142(11)	125(8)	89(14)	118(12)
Typing support	145(7)	128(8)	135(7)	136(6)	132(15)	126(7)	101(10)	120(11)
Research assistants provided by school	133(10)	149(5)	125(13)	135(7)	136(14)	116(11)	83(16)	112(14)
Compensation above your base pay from funds generated within your university	136(8)	116(12)	148(4)	133(8)	122(16)	81(20)	82(18)	95(19)
Funding for research assistants, supplies . . .	133(10)	130(7)	136(6)	133(8)	120(17)	110(14)	81(19)	104(17)
Compensation above your base pay from funds generated outside your university	133(10)	120(9)	135(7)	130(10)	118(19)	96(18)	80(20)	97(18)
Access to computer-based data banks	177(4)	106(15)	104(16)	129(11)	174(7)	117(10)	91(13)	127(8)

TABLE 6—(*Continued*)

Research Facilitators	*Relative Importance to Research (library holdings = 100)* Group *High*	*Middle*	*Low*	*Total*	*Relative Provision/Support of Employer (average program = 100)* Group *High*	*Middle*	*Low*	*Total*
Access to computer consulting for assistance with research projects	130(12)	116(12)	133(10)	126(12)	155(9)	114(12)	110(8)	126(9)
Opportunity to teach graduate courses**	121(16)	120(9)	134(9)	125(13)	200(4)	145(3)	135(1)	160(3)
Travel support	123(15)	119(11)	130(11)	124(14)	150(10)	136(6)	110(8)	132(7)
High quality of undergraduate students	125(14)	112(14)	110(15)	116(15)	200(4)	139(5)	114(6)	150(5)
Access to statistical consulting for assistance with research projects	114(17)	102(18)	119(14)	112(16)	138(12)	106(15)	92(12)	112(14)
Research record of the school at which you are employed	128(13)	106(15)	100(17)	111(17)	210(3)	141(4)	126(4)	159(4)
Library holdings	100(18)	100(19)	100(17)	100(18)	167(8)	111(13)	101(10)	125(10)
Consulting activities**	68(20)	103(17)	97(19)	89(19)	119(18)	104(17)	113(7)	112(14)
Other clerical support	81(19)	92(20)	90(20)	88(20)	98(20)	96(18)	83(16)	92(20)
Correlation between average importance to research and provision/support of employer			Pearson		.6228	.3064	−.1132	.3544
			Spearman Rho		.3239	.3678	−.1318	.1605

* Importance to research significant at .05 level.
** Importance to research significant at .10 level.

TABLE 7

MEAN RESPONSE OF REWARD SYSTEM SECTION OF QUESTIONNAIRE FOR GROUPS DETERMINED BY SCHOOL*

	Promotion				*Tenure*				*Salary Increases*			
	Group				*Group*				*Group*			
	1	*2*	*3*	*Total*	*1*	*2*	*3*	*Total*	*1*	*2*	*3*	*Total*
Published research	666	546	329	509	689	506	313	497	421	386	219	340
Teaching	323	201	224	248	332	198	228	251	273	181	175	209
Politics	144	153	88	127	154	160	109	140	136	127	91	117
Service (anchor item)	100	100	100	100	100	100	100	100	100	100	100	100

*Mean Correlation Between Rewards***

	Group 1		*Group 2*		*Group 3*		*Total*	
	Tenure	*Salary*	*Tenure*	*Salary*	*Tenure*	*Salary*	*Tenure*	*Salary*
Promotion	.9451	.8391	.9255	.8108	.9223	.8101	.9309	.8200
Tenure		.8265		.8128		.7591		.8003

* Evaluation of academic activities based on respondent perception of their importance to their current employer for promotion, tenure, and salary increases.

** For each respondent, correlations were determined between his or her perception of the importance of the academic activities for salary, tenure, and promotion. The table gives the average correlation for each group of respondents.

Table 5, the top five facilitators overall for relative importance to research are also the top five facilitators—though not necessarily in the same order—for each academic rank group. This increase in concordance is also reflected in the reduced number of significant differences for across-group mean comparisons. Moreover, for MANOVAs using individual publications to group respondents, the group effect as shown in the bottom part of Table 4 is not as significant as for the groups determined by the research environment.

In addition to these general observations, a few specific comments are warranted. Table 5 indicates a higher relative importance of access to computers for assistant and associate professors than for full professors. Moreover, assistant professors seem to value the research abilities of fellow faculty members more than do associate and full professors. In terms of employer provision/support, full professors seem to be less satisfied with the amount of committee assignments provided by their employers.

Table 6 reveals that "high" publishers (those who publish primarily in academically oriented journals) find access to the computer to be highly important as compared to the "middle" and "low" publishers. Similarly, access to computer-based data banks ranks number four in relative importance for "high" publishers and only 15 and 16 for "middle" and "low" publishers. "High" publishers also appear to value the research abilities of their fellow faculty to a greater extent than the other two groups. In terms of employer provision/support, "low" publishers seem to be the least satisfied with employer provision of time for conducting research.

REWARD SYSTEM

Table 7 reflects the perceptions of respondents about which of the four factors—published research, teaching, politics, and service—are most important *at their present place of employment* in decisions on promotion, tenure, and salary increases. Importance again was based on a relative comparison with an anchor item, in this case "service" (to school, community, profession, administration, etc.), which was assigned a value of 100. With regard to all three decisions, published research and teaching ranked one and two, respectively, with politics usually third, ahead of service in relative importance.

For all three decisions, published research clearly was perceived to have the greatest relative importance as a determining factor. If it is true that nondoctoral programs place more emphasis on teaching than on research, one might expect that teaching would be perceived by Group 3 respondents as more important than research for one or more of the three reward decisions. This is not the case. However, it is obvious that for all decisions the magnitudes of differences between the relative importance of published research and teaching for Group 3 were not as great as those for Groups 1 and 2. In light of the results in a previous section, which indicate that the accounting programs of Group 3 respondents do not provide/support important research facilitators particularly well, the perceived importance attached to research by these programs may be seen as placing an extra burden on their faculty members.[20]

As would be expected, given the generally consistent pattern in relative importance values, there were high correlations between responses on any two of the three reward decisions. As Table 7 indicates, the lowest correlation (0.76) was in Group 3 responses for tenure and salary increase decisions. All other correlations within groups were 0.81 or higher.

In summary, for the accounting programs of Group 1 and 2 respondents, and to a slightly lesser extent those of Group 3 respondents, there definitely appear to be perceptions of high emphasis on published research for promotion, tenure, and salary increase decisions.[21]

OTHER RESEARCH SUPPORT

Table 8 summarizes responses to selected questions from the "Research Support" section of the questionnaire involving analysis of respondent work activities. Respondents were asked what percentage of their work time per week was spent in each of the areas of teaching, research, service activities, and consulting activities. As might be expected, faculty in Group 1 accounting programs on average spent more time per week on research (38.6 percent) than those in either Group 2 (28.7 percent) or Group 3 (28.1 percent).

Percentages of time spent on teaching ranked as would be expected across the three groups. Group 3 respondents on average spent the most work time per week on teaching (51.5 percent), Group 2 was next (47.0 percent), and Group 1 spent the least work time per week on teaching (38.7 percent). It is noteworthy that Group 1 respondents on average spend as much time on research as they do

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[20] As can be seen from Table 1, however, this research emphasis in Group 3 programs results primarily in practitioner-oriented publications.

[21] As an extension of this analysis, respondents were also grouped solely on the basis of tenured/nontenured status. With only one exception (politics for salary increases), nontenured faculty had greater average relative importance values for published research, teaching, and politics for all three decisions than did tenured faculty.

TABLE 8

ANALYSIS OF ACTIVITIES FOR GROUPS DETERMINED BY SCHOOL

Average percentage of time spent on various activities

	Group 1	2	3	*Total*
Teaching	38.7	47.0	51.5	45.8
Research	38.6	28.7	28.1	31.7
Service	17.2	16.8	14.7	16.4
Consulting	8.5	12.8	10.3	10.4

Teaching Load

	Quarter *No.*	*Mean Hours*	*Mean Class Size*	*Semester* *No.*	*Mean Hours*	*Mean Class Size*	*Trimester* *No.*	*Mean Hours*	*Mean Class Size*	*No Response* *No.*	*Total* *No.*
Group 1	7	6.00	75.14	56	7.05	68.04	4	6.50	49.50	0	67
Group 2	21	8.00	50.20	47	8.79	60.57	3	7.00	43.67	1	72
Group 3	17	8.94	51.88	49	9.31	56.54	2	9.00	60.00	1	69
	45			152			9			2	208

Preparation Requirements

Number of course preparations

	No Response	1 *No.*	*%*	2 *No.*	*%*	3 *No.*	*%*	4 *No.*	*%*	*Average Response*
Group 1	0	23	(34.3)	43	(64.2)	1	(1.5)	0	(0.0)	1.7
Group 2	1	10	(14.1)	51	(71.8)	8	(11.3)	2	(2.8)	2.0
Group 3	1	7	(10.3)	48	(70.6)	10	(14.7)	3	(4.4)	2.1
	2	40		142		19		5		

on teaching. Again, Groups 2 and 3 are more similar in this regard than might be expected. As discussed previously, Table 3 clearly indicates that all groups perceive "reduced teaching load" to be an important research facilitator and all groups perceive their employers as not providing/supporting this item as well as other important research facilitators.

Percentages of work time spent on service exceeded work time spent on consulting activities for all three groups, with Group 1 respondents spending on average more work time on service (17.2 percent) and less on consulting (8.5 percent) than respondents in either Groups 2 or 3. If service and consulting work time are combined in Group 2, about as much work time is spent on these two items as on research, on average, by faculty members in these programs. Combining these same two items in Group 3 also brings them close to the time spent on research by these respondents.

Next, Table 8 summarizes information about teaching loads and class sizes broken down by academic calendar systems. Information also is provided for the number of typical course preparations per calendar segment. Whatever the calendar segment, mean hours taught per week were lowest for Group 1 respondents, higher for Group 2 respondents, and highest for Group 3 respondents. Generally, Group 2 mean hours of class time were closer to those of Group 3 than to those of Group 1.

Mean class sizes are larger for Group 1 respondents than for any other group except for those under the trimester system. Even here, they are larger for Group 1 than for Group 2. It would appear then that even though Group 1 respondents spend less time in the classroom than their counterparts in the other groups, they generally service a larger number of students per class. However, this large average is affected by several respondents who obviously were teaching large lecture classes. There were many respondents in Groups 1 and 2 who had low teaching loads and reasonable class sizes. Number of course preparations by group also reveals that Group 1 respondents overall have the lowest course preparation requirement, with Groups 2 and 3 following in that order. The "norm" for course preparations clearly is two per calendar segment.

SUMMARY AND CONCLUSIONS

This study addresses the following question: What are the predominant characteristics of the "research environment" in the academic accounting community associated with scholarly publication? Because response to the questionnaire was somewhat low, caution should be taken in generalizing the applicability of the research environmental findings reported here. Moreover, there are undoubtedly important research outlets and environmental or individual research factors not considered in this study. Alternative methods of grouping the data are also possible, and two are illustrated in the paper. Nonetheless, important research facilitators, as perceived by respondents overall, were access to the computer, two time-related items (reduced teaching loads and committee assignments), and two people-related items (abilities or quality of fellow faculty members and graduate students). Respondents' perceptions of employer provision/support of these research facilitators generally were more favorable (higher employer facilitation) for people-related items, less favorable for access to the computer, and least favorable for time-related items. Respondents in all accounting programs perceived published research to be a more important factor in promotion, tenure, and salary increase decisions than teaching, service, or politics, although Group 1 and 2 respondents placed higher relative importance on published research than did Group 3 respondents.

In general, the relative importance values of research facilitators (and rankings) for Groups 1 and 2 respondents are quite similar as are the perceptions of the reward systems at their respective places of employment. However, in terms of actual time spent on research (versus teaching and other activities) and teaching loads (time spent per week in the classroom, number of course preparations per calendar segment), Group 2 respondents are more similar to their Group 3 counterparts in nondoctoral degree-granting programs. Both groups spend less time on research and more on other activities than do Group 1 respondents. Groups 2 and 3 respondents also are more similar in their publication output over the period examined in this study.

The results of this study strongly suggest the perception by academic accountants that time availability enhances research productivity. They also strongly suggest the perception of a relative lack of support/provision of time for conducting research. In light of the academic environment that most accounting programs presently can afford to provide, compromises may need to be made with regard to expectations of faculty members' research productivity until such time as increased research support becomes available.

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Publication Productivity of Doctoral Alumni: A Time-Adjusted Model

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ABSTRACT: Prior studies have ranked doctoral programs in accounting on the basis of various input and output criteria. This study ranks doctoral programs on the basis of the publication productivity of their graduates. The primary advantage of this study over prior studies is that it adjusts the publication productivity measures of the schools to reflect differences in the number of doctoral alumni as well as the age of the doctoral program.

NUMEROUS studies have ranked academic accounting programs according to various criteria. Estes [1970] ranked accounting programs using perceptions of quality obtained via questionnaire. Carpenter, Crumbley, and Strawser [1974] surveyed accounting educators for their opinions regarding the quality of both faculties of accounting programs and doctoral programs. Bazley and Nikolai [1975] improved upon the earlier studies by measuring the publication success in four journals of doctoral graduates and the faculty of their degree-granting institutions. The journals selected by Bazley and Nikolai were THE ACCOUNTING REVIEW, *Journal of Accounting Research, Journal of Accountancy* and *Management Accounting* for the period from January 1968 to July 1974. Andrews and McKenzie [1978] introduced faculty size and journal quality into one of the rankings provided by Bazley and Nikolai. Windal [1981] expanded the group of journals studied to 12, and he ranked accounting programs by the number of publications by the faculties of those programs during 1973 to 1977.

Previous studies have relied heavily upon the number of faculty publications which have appeared in selected academic and professional journals as a surrogate measurement for the quality of the institution. Since faculty publications are a byproduct of scholarly activity, the publication quantity and/or quality of the faculty of a university may provide an indirect measure of the quality of the doctoral program.

The purpose of this study is to evaluate the performance of accounting doctoral programs by developing a size- and time-adjusted publication productivity index of doctoral graduates.

RESEARCH METHOD

The data collected for the study span a 13-year period from January 1972 through December 1984; therefore, the measure-

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ment is a considerably longer period than the six-and-one-half-year period selected by Bazley and Nikolai [1975] or the five-year period studied by Windal [1981]. Additionally, several doctoral programs are included which did not produce graduates during the earlier periods examined by previous studies. The time period chosen for the study limited the selection of journals to those that were published during the entire period. (See Table 1 for the journals selected.) Hence, several prominent journals have been excluded.[1] In addition to meeting the publication time requirement, the eight journals selected are traditional outlets for accounting research. The journals include the four used by Bazley and Nikolai and seven of the 12 chosen by Windal. Seven of the eight journals used in this study were among the top ten journals ranked by Weber and Stevenson [1981], and all of the eight were ranked by Benjamin and Brenner [1974] within their top 18 general journals evaluated. The eight journals selected may also be viewed as a representative sample of journals which would allow the statistics generated in this study to be useful in estimating parameters of a population of journals much larger than the sample.[2]

The author(s) of main section articles published in the eight journals throughout the 13-year period were identified. Only main section articles were included because of the diversity that exists among the various correspondence and departmental sections appearing within the eight journals selected. Relying upon the precedent established by earlier studies, there seems to be little evidence to suggest that the inclusion of notes and/or departmental munuscripts would substantially affect the reliability of the study. The authorship data (i.e., the university granting the author's doctoral degree and the date of graduation) were obtained from Hasselback's *Accounting Faculty Directory* [1976–1985]. The number of graduates from each doctoral program was also obtained from Hasselback.

RESULTS

Overall publication success was used to rank the top 25 schools in each of the subsequent tables. Composite rankings were obtained in each instance by weighting the journal articles equally. Since some readers may feel that articles published in the various journals should not be assigned equal value, all tables contain actual publication data by school as well as individual journal. The inclusion of actual publication elements by journal may facilitate data analysis for those who wish to adjust the results by incorporating subjective weightings.

Ranking by Author Lines

One of the ways to measure research output is to count the total number of individual author lines generated by graduates of a particular school (i.e., in the case of joint authorship, each author and his/her respective school is credited with a publication). The schools whose doctoral graduates generated the most author lines are presented in Table 1. The 25 doctoral-granting institutions listed are ranked by the total number of publications in the eight journals for the 13-year period. As indicated previously, Table 1

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[1] At the time this manuscript was submitted for review, the last issue of *Abacus* for 1984 was not available, and therefore it is not included in the data base.

[2] The more specialized journals, such as those dealing with taxation and management information systems, were excluded from this study. Since a wide variety of topic areas is published within the journals selected, it was felt that a disproportionate emphasis would result with the inclusion of any special-interest periodicals. A number of previous studies also excluded these journals. Nevertheless, with the recent increase in the number of doctoral graduates concentrating in taxation and information systems, it may be desirable for subsequent research to investigate specializations directly.

TABLE 1

TOTAL AUTHOR LINES OF DOCTORAL GRADUATES*—(1972–1984)

Rank	School	Total Author Lines	*Journals*															
			Management Accounting		*The Accounting Review*		*Journal of Accounting Research*		*Journal of Accountancy*		*Financial Executive*		*Internal Auditor*		*Abacus*		*CPA Journal*	
			Rank	*No.*	*Rank*	*No.*	*Rank*	*No.*	*Rank*	*No.*	*Rank*	*No.*	*Rank*	*No.*	*Rank*	*No.*	*Rank*	*No.*
1.	Illinois	222	2	34	1	44	6	16	1	43	1	22	1	17	13	2	1	44
2.	Texas	150	3	28	4	33	3	20	2	24	3	8	6	7	5	4	4	26
3.	Michigan State	141	1	37	2	39	7	15	5	15	5	7	4	9	18	1	6	18
4.	Ohio State	100	16	11	2	39	2	24	16	6	8	5	11	4	3	5	18	6
5.	NYU	92	7	20	12	14	13	5	16	6	5	7	23	0	1	8	3	32
6.	LSU	89	5	24	21	2	22	0	13	7	3	8	11	4	13	2	2	42
7.	Michigan	86	13	15	7	18	13	5	3	16	2	17	17	2	13	2	13	11
8.	Chicago	77	20	5	6	25	1	30	16	6	11	4	17	2	9	3	23	2
9.	U. of Washington	76	7	20	7	18	9	11	16	6	8	5	7	6	3	5	20	5
10.	Alabama	74	4	25	24	0	22	0	3	16	15	3	16	3	9	3	5	24
11.	Missouri	72	6	21	15	10	15	3	11	10	8	5	8	5	13	2	9	16
12–13.	Florida	69	9	17	18	5	10	9	8	11	15	3	8	5	5	4	11	15
	Stanford	69	20	5	5	28	3	20	13	7	11	4	19	1	13	2	23	2
14.	Indiana	68	13	15	17	6	17	2	7	12	24	1	3	10	5	4	6	18
15.	Minnesota	60	13	15	11	15	11	8	16	6	20	2	4	9	21	0	20	5
16.	California	59	20	5	10	17	5	17	12	9	20	2	23	0	5	4	20	5
17.	Penn State	57	12	16	14	11	17	2	13	7	15	3	11	4	2	6	16	8
18.	Wisconsin	54	19	10	13	12	17	2	8	11	20	2	11	4	21	0	12	13
19.	Colorado	45	16	11	24	0	22	0	22	2	24	1	2	11	9	3	8	17
20.	Georgia	44	9	17	21	2	20	1	22	2	5	7	11	4	18	1	14	10
21.	Columbia	43	25	3	16	7	12	6	6	14	15	3	19	1	21	0	15	9
22.	Cornell	40	23	4	7	18	7	15	24	0	20	2	23	0	21	0	25	1
23–24.	Maryland	38	23	4	19	4	22	0	16	6	11	4	19	1	9	3	9	16
	Texas Tech	38	16	11	20	3	15	3	8	11	15	3	19	1	21	0	18	6
25.	Arkansas	37	9	17	21	2	20	1	24	0	11	4	8	5	18	1	17	7

* Includes only Ph.D., DBA and DCS. Excludes non-accounting doctoral graduates as determined from Hasselback. Sub-rankings by journal are not absolute; they are analogous to a Bayesian ordinal ranking. For example, the school that is ranked fourth in publications in *Abacus* is not necessarily fourth given all universities surveyed. It is fourth, given the top 25 schools in this category.

TABLE 2
EQUIVALENT WHOLE PUBLICATIONS OF DOCTORAL GRADUATES*—(1972–1984)

Rank	School	Total Eq. Whole Publications	Journals															
			Management Accounting		*The Accounting Review*		*Journal of Accounting Research*		*Journal of Accountancy*		*Financial Executive*		*Internal Auditor*		*Abacus*		*CPA Journal*	
			Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
1.	Illinois	152.9	1	26.3	1	33.2	9	9.7	1	28.6	1	15.0	1	11.0	15	1.5	2	27.7
2.	Texas	99.3	3	20.7	4	22.0	3	15.3	2	13.8	5	4.7	5	4.8	9	2.5	4	15.5
3.	Michigan State	98.8	2	25.9	3	28.5	8	9.8	4	9.8	6	4.3	3	7.0	19	0.5	6	12.8
4.	Ohio State	67.2	17	6.0	2	28.7	2	17.5	21	3.2	15	1.8	12	2.3	1	4.0	18	3.7
5.	NYU	65.0	6	15.5	14	8.0	14	2.8	15	4.5	4	5.8	22	0.0	1	4.0	3	24.3
6.	Michigan	63.5	10	13.2	9	12.2	15	2.3	5	9.6	1	15.0	19	0.8	10	2.0	11	8.5
7.	LSU	62.9	6	15.5	21	1.5	23	0.0	14	4.6	3	6.0	10	3.5	10	2.0	1	29.8
8.	Chicago	56.8	21	3.8	6	18.2	1	20.3	12	6.0	7	3.5	16	1.5	10	2.0	22	1.5
9.	U. of Washington	53.3	5	15.7	7	13.7	10	8.2	20	3.3	11	2.6	9	3.8	5	3.0	20	3.0
10.	Missouri	51.1	4	16.3	15	7.5	16	2.0	11	6.1	12	2.3	7	4.5	18	1.0	7	11.3
11.	Florida	50.7	9	13.5	20	3.8	11	6.8	7	7.3	15	1.8	11	2.8	3	3.5	9	11.0
12.	Stanford	48.8	20	4.0	5	20.3	4	14.6	18	3.8	9	3.0	20	0.5	15	1.5	23	1.0
13.	Indiana	44.7	11	10.8	18	4.8	16	2.0	6	7.5	24	0.5	5	4.8	5	3.0	8	11.2
14.	California	42.8	21	3.8	10	11.5	5	13.3	9	6.3	18	1.3	22	0.0	5	3.0	19	3.5
15.	Alabama	42.6	8	14.8	24	0.0	23	0.0	8	6.4	13	2.0	14	2.0	10	2.0	5	15.3
16.	Wisconsin	38.5	15	7.3	12	10.5	21	1.0	9	6.3	22	0.8	8	4.0	21	0.0	11	8.5
17.	Columbia	36.5	24	2.5	17	5.3	13	3.7	3	13.0	9	3.0	20	0.5	21	0.0	11	8.5
18.	Minnesota	35.8	14	7.5	13	9.8	12	5.0	18	3.8	18	1.3	4	5.3	21	0.0	20	3.0
19.	Colorado	30.7	13	8.3	24	0.0	23	0.0	22	1.5	25	0.3	2	7.5	10	2.0	9	11.0
20.	Penn State	29.5	15	7.3	16	5.7	16	2.0	17	4.0	17	1.5	15	1.8	4	3.2	17	4.0
21.	Cornell	28.3	23	3.5	8	13.0	7	10.8	24	0.0	23	0.7	22	0.0	21	0.0	24	0.3
22.	Oklahoma	26.7	18	5.3	21	1.5	16	2.0	15	4.5	20	1.2	18	1.3	8	2.8	14	8.0
23.	Georgia	26.0	11	10.8	21	1.5	22	0.3	23	1.0	8	3.2	12	2.3	19	0.5	15	6.3
24–25.	Carnegie-Mellon	25.7	25	0.0	11	10.8	6	12.8	24	0.0	13	2.0	22	0.0	21	0.0	25	0.0
	Pennsylvania	25.7	19	4.8	19	4.5	20	1.5	13	5.8	21	1.0	16	1.5	15	1.5	16	5.0

* Includes only Ph.D., DBA and DCS. Excludes non-accounting doctoral alumni as determined from Hasselback. Sub-rankings by journal are not absolute; they are analogous to a Bayesian ordinal ranking. For example, the school that is ranked fourth in publications in *Abacus* is not necessarily fourth given all universities surveyed. It is fourth, given the top 25 schools in this category.

also shows subrankings of those schools by publication success in each of the selected journals. It should be noted that the rankings in Table 1 contain an inherent bias; the older and larger doctoral programs are favored since they have a larger group of graduates available to generate publications.

Rankings Adjusted for Co-Authorship

Another measure of research output is the total number of equivalent whole publications generated by a school. This measure requires that, in the case of a joint authorship, each author be given credit for a pro-rata share of a single publication [Bazley and Nikolai, p. 606]. The "equivalent whole publications" in all eight journals are used as the ranking criterion in Table 2 to determine the 25 schools whose graduates were the most prolific. As was the case in Table 1, these calculations tend to be biased by the size and age of the doctoral program, thereby favoring the larger and older programs.

Rankings Adjusted for Size

To reduce or eliminate size as a confounding influence on the rankings, adjustments for the quantity of doctoral graduates were made. Table 3 shows the results obtained when the data in Table 2 are adjusted for the size of the respective doctoral programs as measured by the number of graduates. The total number of doctoral graduates of a particular school was divided into the total equivalent whole publications achieved by a school's doctoral graduates to derive the average publications per graduate. The 25 schools whose doctoral graduates achieved the highest "average equivalent whole publications" in all eight journals for the time period are shown in Table 3. These schools produced average whole publications ranging from 3.667 articles to 0.650 articles per student.

Rankings Adjusted for Available Work-Years

A variety of evaluation models have been used to measure the performance of doctoral programs. Assuming that the journal selection and the time periods chosen are representative, the major limitations of some earlier studies have been a failure to adjust the data for both the quantity of graduates and the number of years since graduation. Certainly, one would not wish to compare the record of one individual with the record of ten; just as surely, one would not want to make an equal comparison of the accomplishments of an individual over a ten-year period with another's accomplishments in one year.

A better measure of doctoral program potential and quality may be obtained by relating publication success to the *available working years* for graduates. Table 4 presents a ranking of doctoral programs by the number of *equivalent whole publications per year per graduate* over the 13-year period. *Equivalent whole publications per available work year,* as shown in Table 4, is calculated by dividing the total equivalent whole publications provided in Table 2 by the total graduate work-years available for publishing for a given doctoral program, calculated as follows:

$$\sum_{i=b}^{1971} 13\, G_i + \sum_{i=1972}^{1984} (1984-i)\, G_i$$

where

G_i = the number of accounting graduates in the ith year.

b = the year of first accounting doctoral graduates.

This ranking reduces the bias which favored larger schools and older doctoral programs in Tables 1, 2, and 3 by creating an equalizing measure of publications per

TABLE 3

AVERAGE EQUIVALENT WHOLE PUBLICATIONS PER DOCTORAL GRADUATE*—(1972–1984)

				Journals							
Rank	*School*	*Number of Alumni*	*Average Equivalent Whole Publications Per Doctoral Alumnus*	*Management Accounting*	*The Accounting Review*	*Journal of Accounting Research*	*Journal of Accountancy*	*Financial Executive*	*Internal Auditor*	*Abacus*	*CPA Journal*
1.	Pennsylvania	7	3.667	.691	.643	.214	.833	.143	.214	.214	.714
2.	Carnegie-Mellon	15	1.711	.000	.722	.856	.000	.133	.000	.000	.000
3.	Cornell	18	1.574	.194	.722	.602	.000	.037	.000	.000	.019
4.	Cincinnati	14	1.417	.214	.107	.000	.000	.107	.464	.036	.488
5.	Maryland	16	1.354	.094	.177	.000	.271	.135	.031	.125	.521
6.	NYU	54	1.204	.287	.148	.053	.083	.108	.000	.074	.451
7.	Stanford	41	1.189	.098	.496	.356	.094	.073	.012	.037	.024
8.	Chicago	49	1.160	.078	.371	.415	.122	.071	.031	.041	.031
9.	Florida	47	1.078	.287	.082	.145	.156	.039	.060	.075	.234
10.	CUNY	11	1.076	.091	.091	.000	.091	.136	.091	.000	.576
11.	Purdue	8	.969	.125	.844	.000	.000	.000	.000	.000	.000
12.	Kansas	13	.949	.115	.487	.077	.115	.000	.000	.039	.115
13.	Columbia	41	.890	.061	.130	.089	.317	.073	.012	.000	.207
14.	Oklahoma	30	.889	.178	.050	.067	.150	.039	.044	.094	.267
15.	Michigan State	113	.874	.229	.252	.087	.087	.038	.062	.004	.114
16.	Michigan	73	.870	.180	.167	.031	.131	.206	.011	.027	.116
17.	Houston	24	.826	.354	.181	.000	.076	.000	.049	.000	.167
18.	California	52	.824	.074	.221	.256	.122	.026	.000	.058	.067
19.	Ohio State	84	.780	.071	.341	.208	.038	.022	.028	.048	.044
20.	Oregon	20	.792	.350	.275	.000	.042	.000	.075	.025	.025
21.	U. of Washington	71	.750	.221	.193	.115	.047	.036	.054	.042	.042
22.	Texas Tech	30	.747	.236	.050	.083	.183	.050	.017	.000	.128
23.	Rochester	7	.738	.143	.286	.262	.048	.000	.000	.000	.000
24.	Colorado	42	.730	.198	.000	.000	.036	.008	.179	.048	.262
25.	Iowa	24	.715	.146	.097	.104	.056	.146	.042	.021	.104

* Includes only Ph.D., DBA and DCS. Excludes non-accounting doctoral alumni as determined from Hasselback. The data are rounded to the nearest third decimal.

TABLE 4

AVERAGE ANNUAL PUBLICATIONS PER DOCTORAL GRADUATE*—(1972-1984)

				Journals							
Rank	*School*	*Total Work Years*	*Equivalent Whole Publications Per Available Work Year*	*Management Accounting*	*The Accounting Review*	*Journal of Accounting Research*	*Journal of Accountancy*	*Financial Executive*	*Internal Auditor*	*Abacus*	*CPA Journal*
1.	Pennsylvania	63	.407	.077	.071	.024	.093	.016	.024	.024	.079
2.	Cornell	118	.240	.030	.110	.092	.000	.006	.000	.000	.003
3.	Carnegie-Mellon	122	.210	.000	.089	.105	.000	.016	.000	.000	.000
4.	CUNY	57	.208	.018	.018	.000	.018	.026	.018	.000	.111
5.	Tennessee	75	.180	.073	.016	.016	.016	.007	.031	.000	.022
6.	Cincinnati	112	.177	.027	.013	.000	.000	.013	.058	.005	.061
7.	Maryland	128	.169	.012	.022	.000	.034	.017	.004	.016	.065
8.	Rochester	31	.167	.032	.065	.059	.011	.000	.000	.000	.000
9.	VPI	49	.150	.051	.027	.000	.020	.010	.041	.000	.000
10.	Houston	138	.144	.062	.031	.000	.013	.000	.009	.000	.029
11.	Oklahoma	218	.1223	.025	.007	.009	.021	.005	.006	.013	.037
12.	Kansas	101	.1221	.015	.063	.010	.015	.000	.000	.005	.015
13.	Stanford	423	.115	.010	.048	.035	.009	.007	.001	.004	.002
14.	NYU	572	.114	.027	.014	.005	.008	.010	.000	.007	.043
15.	Florida	462	.110	.029	.008	.015	.016	.004	.006	.008	.024
16.	Purdue	72	.108	.014	.094	.000	.000	.000	.000	.000	.000
17.	Chicago	548	.104	.007	.033	.037	.011	.006	.003	.004	.003
18.	Georgia	266	.098	.041	.006	.001	.004	.012	.009	.002	.024
19.	Iowa	182	.094	.019	.013	.014	.007	.019	.006	.003	.014
20.	Oregon	171	.093	.041	.032	.000	.005	.000	.009	.003	.003
21.	Texas Tech	245	.092	.029	.006	.010	.022	.006	.002	.000	.016
22.	Kentucky	222	.087	.029	.000	.000	.009	.009	.011	.000	.029
23.	Colorado	367	.084	.023	.000	.000	.004	.001	.020	.005	.030
24.	Michigan	779	.082	.017	.016	.003	.012	.019	.001	.003	.011
25-26.	Columbia	451	.081	.006	.012	.008	.029	.007	.001	.000	.019
	Penn State	365	.081	.020	.016	.006	.011	.004	.005	.009	.011

* Includes only Ph.D., DBA and DCS. Excludes non-accounting doctoral graduates as determined from Hasselback. Doctoral programs with less than five graduates were excluded from the analysis. The data are rounded to the nearest third decimal, except for tie-breakers.

available working year. If the study period and the journals selected are viewed as reasonably representative, the results shown in Table 4 may be used as an indicator of the average expected publications per year of a graduate from a specific school.

The results obtained from making these adjustments are intriguing primarily because several schools appear in this ranking that were entirely absent from the other tables. Conversely, some schools that had high rankings in all previous measures are completely absent from this list. Assuming that these publication trends continue, the results of this study imply that the perceived quality rankings of doctoral programs may undergo substantial changes.

It is noteworthy that schools such as Tennessee and VPI did not appear on any other ranking in this study, but they are shown in the leading ten schools in the time-adjusted productivity measure. In addition, as an *ex ante* analysis might have concluded, a high total publication output does not appear to be closely related to high productivity, given an equivalent number of working years.

SUMMARY

Previous studies have ranked schools of accountancy and their doctoral programs using various criteria as indicators of quality. These rankings have resulted from questionnaires asking for subjective opinions regarding a school's quality and from empirical studies using the publication output of a school's resident faculty and/or doctoral graduates.

An objective measurement of a doctoral program is important since numerous and diverse benefits may accrue to an academic institution whose faculty and graduates are actively engaged in research and publication. This study evaluated the specific success of doctoral programs by establishing a relatively objective output measurement that provides a size- and time-adjusted publication productivity index of accounting doctoral graduates.

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American Accounting Association

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Charge: To select one or two recipients of the Outstanding Accounting Educator Award using the criteria approved by the Executive Committee.

Chairperson: William H. Beaver, Stanford University
Members: William J. Bruns, Jr., Harvard University
Anthony R. Carbone, Massachusetts Bay Community College
Paul Danos, The University of Michigan
Michael H. Granof, The University of Texas at Austin
Frederick L. Neumann, University of Illinois at Urbana-Champaign

ACCREDITATION COMMITTEE

Charge: 1. To advise and make recommendations to the Executive Committee as appropriate regarding the role of the AAA in the accounting accreditation process, and the actions that the AAA can take to assist members in complying with AACSB accounting accreditation requirements.

2. To monitor the activities of, and work with, the appropriate committees of the AACSB regarding accreditation to assure that the accreditation standards are applied fairly, yet flexibly, in the process of accrediting programs that possess strong academic qualifications.

3. To serve as a liaison with the AACSB in helping qualified academics serve as accreditation teams.

Chairperson: Allan R. Bailey (1986), San Diego State University
Members: James R. Boatsman (1988), Oklahoma State University
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Rick Elam (1987), University of Missouri-Columbia
William Markell (1988), University of Delaware
Douglas R. Martin (1986), Siena College

AUDITING STANDARDS COMMITTEE

Charge: 1. To prepare and transmit written and oral views to the AICPA's Auditing Standards Board and Accounting and Review Services Committee, the International Auditing Practices Committee, and the Institute of Internal Auditors in response to exposure drafts, discussion papers and other publicly circulated documents.

2. To propose topics and possible research approaches that might be considered by the bodies enumerated in (1).

3. To recommend to the Executive Committee any other useful roles that the Association might play in the work of auditing standard-setting bodies.

Chairperson: Zoe-Vonna Palmrose, University of California, Berkeley
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C. William Thomas, Baylor University
Bart H. Ward, University of Oklahoma

BY-LAWS COMMITTEE

Charge: To advise the Executive Committee on changes in the By-Laws of the Association.

Chairperson: Alan P. Johnson, California State University, Hayward
Members: Robert E. Seiler, University of Houston-University Park
Jerry J. Weygandt, University of Wisconsin-Madison

CARTER SCHOLARSHIP COMMITTEE

Charge: 1. To collect and evaluate applications for the Carter-funded student scholarships.
2. To review the policy on amounts of stipends.
3. To rank applications and to transmit the ranking to the Trustees of the fund.

Chairperson: Talmadge C. Tillman, Jr., California State University, Long Beach
Members: J. Herman Brasseaux, University of New Orleans
William M. Voss, Ohio University

COMPETITIVE MANUSCRIPT AWARD COMMITTEE

Charge: To select recipient(s) of the Competitive Manuscript Award.

Chairperson: George Foster, Stanford University
Members: Andrew D. Bailey, Jr., The Ohio State University
Stanley Baiman, Carnegie-Mellon University
David F. Larcker, University of Pennsylvania
Gerald L. Salamon, The University of Iowa
Wilfred C. Uecker, Rice University

CONTEMPORARY APPROACHES TO TEACHING INFORMATION SYSTEMS COMMITTEE

Charge: 1. To identify the unique problems of teaching information systems in an accounting curriculum.
2. To propose ways and means of dealing effectively with those problems.

Chairperson: Theodore J. Mock, University of Southern California
Members: Barry E. Cushing, University of Utah
Gordon B. Davis, University of Minnesota-Twin Cities
Miklos A. Vasarhelyi, Columbia University
Clinton E. White, Pennsylvania State University
Joseph W. Wilkinson, Arizona State University

DELOITTE HASKINS & SELLS WILDMAN MEDAL COMMITTEE

Charge: To administer the John R. Wildman Medal in accordance with the terms of the grant from Deloitte Haskins & Sells Foundation.

Chairperson: W. Morley Lemon, University of Waterloo
Members: Loyd Heath, University of Washington
James R. Ladd, Deloitte Haskins & Sells, New York
Stephen E. Loeb, University of Maryland
Edward Stamp, University of Lancaster
Clyde P. Stickney, Dartmouth College

DOCTORAL CONSORTIUM COMMITTEE

Charge: 1. To plan the 1986 Doctoral Consortium.
2. Upon approval and funding, to arrange to have the Consortium conducted and administered.
3. To report on its results, effectiveness, and recommended changes by November 1, 1986.

Chairperson: Nicholas Dopuch, Washington University
Members: Gary C. Biddle, University of Washington
John A. Elliott, Cornell University
Paul A. Griffin, University of California, Davis

DOCTORAL PROGRAMS COMMITTEE

Charge: 1. To propose actions which the Association may take to improve the quality of doctoral studies in accounting and the quantity of doctorates awarded in accounting.
2. To advise the Director of Education in the planning for the 1986-87 Doctoral Programs Conference.

Chairperson: Terry L. Campbell, University of Central Florida
Members: Gadis J. Dillon, University of Kentucky
Ronald J. Huefner, State University of New York, Buffalo
J. Hal Reneau, Arizona State University
Thomas H. Williams, University of Wisconsin-Madison

EDUCATION ADVISORY COMMITTEE

Charge: 1. To advise the Director in the development and administration of the Association's education program.
2. To suggest innovations to improve the Association's education program by enhancing the quality of programs and publications.

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Vice Chairperson: Donald L. Madden (1986), University of Kentucky
Members: Thomas H. Beechy (1988), York University
B. Gary Dando (1988), Ernst & Whinney, Cleveland
Thomas P. Howard (1987), University of Missouri-Columbia
Daniel L. Jensen (1986), The Ohio State University
Salvatore Luiso (1987), Coopers & Lybrand, New York
Belverd E. Needles, Jr. (1987), De Paul University
Lawrence C. Phillips (1987), University of Miami
David N. Ricchiute (1986), University of Notre Dame
Jack Topiol (1988), Community College of Philadelphia

FEDERAL TAX COMMITTEE

Charge: 1. To initiate, coordinate and develop, when deemed appropriate, proposals to the Treasury and to national legislative bodies and their associated committees.
2. To respond to requests for advice on proposed legislation and regulations, including oral testimony when appropriate.

Chairperson: Silvia A. Madeo, The University of Iowa
Members: Mary Sue Gately, Texas Tech University
Joseph E. Gibson, University of Virginia
Valerie C. Milliron, Pennsylvania State University
Michael A. O'Dell, Arizona State University
Edmund Outslay, Michigan State University
Karin Skadden, University of North Carolina at Chapel Hill

FINANCIAL ACCOUNTING STANDARDS COMMITTEE

Charge: 1. To prepare and transmit written and oral views to the Financial Accounting Standards Board and Accounting Standards Executive Committee in response to exposure drafts, discussion memoranda and other publicly circulated documents related to profit-seeking enterprise.
2. To propose topics and possible research approaches that might be considered by the FASB and AcSEC.

3. To recommend to the Executive Committee any other useful roles that the Association might play in the standard-setting areas embraced by the work of the FASB and AcSEC.

Chairperson: Paul B. W. Miller, University of Utah
Members: Paul R. Brown, Yale University
Walter T. Harrison, Jr., Baylor University
Bill D. Jarnagin, University of Tulsa
Jimmy W. Martin, University of Montevallo
Michael G. Tearney, University of Kentucky

FUTURE STRUCTURE, CONTENT, AND SCOPE OF ACCOUNTING EDUCATION COMMITTEE

Charge: To examine the changing environment of accounting practice and identify the potential impact upon accounting education and research by the year 2001. The Committee is to consider the possibility that neither accounting education (research and teaching), nor accounting practice, is keeping up with the mass of changes taking place in our economic and social society. The Committee should provide specific recommendations for adjusting accounting education to the new environment.

Chairperson: Norton M. Bedford, University of Illinois at Urbana-Champaign
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Sidney Davidson, University of Chicago
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M. Mendel Piser, Crow, Chizek & Company, South Bend, IN
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John K. Simmons, University of Florida
Edward L. Summers, The University of Texas at Austin
John T. Wheeler, University of California, Berkeley

GOVERNMENT AND NONPROFIT ACCOUNTING COMMITTEE

Charge: 1. To prepare and transmit written and oral views to the Government Accounting Standards Board, Railroad Accounting Principles Board, and the Financial Accounting Standards Board (nonbusiness accounting) in response to exposure drafts, discussion memoranda, and other publicly circulated documents.

2. To propose topics and possible research approaches that might be considered by the bodies enumerated in (1).

3. To recommend to the Executive Committee any other useful roles that the Association might play in regard to standard-setting in the government and nonprofit sectors.

Chairperson: Wanda A. Wallace, Texas A&M University
Members: Robert Capettini, San Diego State University
Mort Dittenhofer, Georgetown University
David F. Drake, American Hospital Association, Chicago
James M. Patton, University of Pittsburgh

INTERNATIONAL ACCOUNTING COMMITTEE

Charge: 1. To prepare and transmit written views to the International Accounting Standards Committee, International Federation of Accountants (except for auditing practices) and other international accounting bodies in response to exposure drafts, discussion papers and other publicly circulated documents.

2. To propose topics and possible research approaches that might be considered by the bodies mentioned in (1).

3. To recommend to the Executive Committee any other useful roles that the Association might play in the international sphere.

Chairperson: Konrad W. Kubin, Virginia Polytechnic Institute and State University
Members: Trevor R. Harris, Columbia University
Oscar J. Holzmann, University of Miami
Sharon M. McKinnon, Northeastern University
Gary K. Meek, Oklahoma State University
John A. Yeakel, University of New Mexico

INTERNATIONAL FACULTY EXCHANGE COMMITTEE

Charge: 1. To advise the Executive Committee on the extent of this program for the 1985-86 and 1986-87 years and for subsequent years, including issues of funding for the program.

2. To select the professors to be involved in the program for 1985-86 and 1986-87.

3. To assist the Executive Director with the arrangements and the distribution of necessary materials for the visits.

Chairperson: Frederick D. S. Choi, New York University
Members: Thomas J. Burns, The Ohio State University
Sidney Gray, University of Glasgow
Yuji Ijiri, Carnegie-Mellon University
Charles H. Smith, University of Illinois at Urbana-Champaign

INVESTMENTS COMMITTEE

Charge: To formulate and recommend to the Executive Committee policies and actions for managing the Association's financial resources.

Chairperson: Jerry J. Weygandt, University of Wisconsin-Madison
Members: Alvin A. Arens, Michigan State University
Doyle Z. Williams, University of Southern California

MEMBERSHIP COMMITTEE

Charge: To increase the quantity and quality of the membership of the Association.

Chairperson: Robert E. Holtfreter, Fort Hays State University
Members: C. Derek Acland, Concordia University
Rodney G. Alsup, Georgia State University
Donald F. Arnold, Union College
Allen W. Bathke, Jr., Florida State University
Cynthia A. Bettinger, McNeese State University
Robert E. Blatz, University of Nevada at Reno
Scott N. Cairns, University of Rhode Island
Lanny G. Chasteen, Oklahoma State University
Doris M. Cook, University of Arkansas
M. Peter Dillaway, New Mexico State University
William A. Duncan, Arizona State University
John Freear, University of New Hampshire
Charles Fazzi, Bucknell University
D. Jacque Grinnell, University of Vermont
Jeffrey Harkins, University of Idaho
Ennis M. Hawkins, Sam Houston State University
John G. Helmkamp, Indiana University
Dora R. Herring, Mississippi State University
Arthur A. Hiltner, University of North Dakota
Gerald B. Hoth, Weber State College
Lal C. Jagetia, Cleveland State University
Howard Kanter, DePaul University
Stuart Keller, University of Kentucky
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Randall Preheim, University of South Dakota
Loudell Ellis Robinson, University of Alabama in Birmingham
Sam S. Sedki, St. Mary's University
Mary Alice Seville, Oregon State University
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Philip H. Siegel, Arkansas State University
John Sigler, University of Baltimore
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Henry Wichman, Jr., University of Alaska, Anchorage
Earl R. Wilson, University of Missouri-Columbia
Harold O. Wilson, Middle Tennessee State University

MINORITY FACULTY DEVELOPMENT COMMITTEE

Charge: 1. To liaise with the AICPA, NABA and other organizations that are working to increase the number of minority faculty teaching in accounting programs.

2. To initiate other activities to foster an interest in doctoral work in accounting, such as the preparation of materials on academic careers in accounting for minorities and collection of data on doctoral program support.

3. To prepare a plan for development for minority faculty members.

Chairperson: George O. Gamble, University of Houston-University Park

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Brenda S. Birkett, Southern University, Baton Rouge

Quiester Craig, North Carolina A&T State University

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Robert K. Zimmer, University of Denver

NOMINATIONS COMMITTEE

Charge: To nominate members of the Executive Committee and Council Members-at-Large.

Chairperson: Yuji Ijiri, Carnegie-Mellon University

Members: Gary L. Holstrum, University of Southern California

Robert W. Ingram, University of Alabama

Daniel L. Jensen, The Ohio State University

John L. Kramer, University of Florida

Harold Q. Langenderfer, University of North Carolina at Chapel Hill

Doyle Z. Williams, University of Southern California

NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD COMMITTEE

Charge: Screening Subcommittee—To identify works of exceptional merit from books and articles that meet the guidelines established by the Executive Committee.

Nominating Subcommittee—To nominate to the AICPA-AAA Notable Contributions to Accounting Literature Committee up to five selected books and articles each from those identified by the Screening Subcommittee as potential notable contributions to the accounting literature. Each nomination should be accompanied by an explanatory discussion of why the work should be considered to be a notable contribution. In addition, the Nominating Subcommittee is to select the recipient of the Seminal Contribution to the Accounting Literature award.

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Thomas R. Dyckman, Cornell University

William L. Felix, Jr., The University of Arizona

Gerald A. Feltham, University of British Columbia

Robert M. Halperin, New York University

Philip E. Meyer, Boston University

Gerhard G. Mueller, University of Washington

Screening Subcommittee: Chairperson: Shane Moriarity Universtiy of Oklahoma

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Anthony M. Tinker, Baruch College, City University of New York

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Rob Weber, University of Queensland

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PEAT, MARWICK, MITCHELL AUDITING SEMINARS COMMITTEE

Charge: To assist Peat, Marwick, Mitchell & Co. in the conduct of the auditing seminar series.

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2. To continue to work closely with the AICPA's Examination Division during this period of in-depth review and potential change, and to provide appropriate advice from the AAA.

3. To develop programs and methods relating to examination objectives, content, techniques, and analysis which may benefit members of the academic and professional examination communities.

4. To elicit questions and problems together with solutions from members for use in licensing and other accounting certification examinations.

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PROGRAM ADVISORY COMMITTEE

Charge: 1. To issue a call for papers for the 1986 AAA Annual Meeting, to review the papers received, and recommend those papers to be presented in concurrent sessions.

2. To recommend moderators, presiders and discussants, as appropriate, for each concurrent session.

3. To rely on the Sections as the chairman thinks is appropriate in the formulation of the recommendations in (1) and (2).

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Hein Schreuder, Rijksuniversiteit Limburg, The Netherlands

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Charge: To advise the President and Executive Committee on the implementation of the two new journals and on the candidates for editorial positions, and to give other advice as seems appropriate on the Association's publications policies and practices.

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Members: Robert N. Anthony, Harvard University
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William L. Ferrara, Pennsylvania State University
Roger H. Hermanson, Georgia State University
D. Gerald Searfoss, Touche Ross & Co., New York
Ray M. Sommerfeld, The University of Texas at Austin

RESEARCH ADVISORY COMMITTEE

Charge: 1. To advise the Director in the development and administration of the Association's accounting research program.

2. To suggest innovations to improve the Association's research program by raising the quality of accounting research, or by improving communication between practitioners and consumers of accounting research.

Chairperson: William R. Kinney, Jr., The University of Michigan
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SEC LIAISON COMMITTEE

Charge: 1. To prepare and transmit written and oral views to the Securities and Exchange Commission in response to notices of proposed rulemaking and other drafts that are publicly circulated.

2. To advise the SEC's Office of Chief Accountant of the committee's views on the accounting and auditing policies and practices of the Commission.

3. To recommend to the Executive Committee any other useful roles that the Association might play in regard to the accounting and auditing work of the Commission.

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Charge: To select the 1986–87 recipients of American Accounting Association grants and determine, within the guidelines established by the Executive Committee, the amounts of their awards.

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Chairperson: James J. Benjamin, Texas A&M University
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L. S. Rosen, York University
P. David Shields, Rice University

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BOOK REVIEWS

Harvey S. Hendrickson, Editor

EDITOR'S NOTE: Books for review should be sent to Professor Harvey S. Hendrickson, School of Accounting, College of Business Administration, Florida International University, Miami, FL 33199.

(The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.)

JEFFREY S. ARPAN and DHIA D. ALHASHIM, *International Dimensions of Accounting* (Boston: Kent Publishing Co., 1984, pp. xiii, 217, $14.25 paper).

This paperback is part of The Kent International Business Series. Its stated purpose is "to identify and explain several major aspects of accounting's international dimensions. It is intended as a supplementary text for undergraduate and graduate courses in accounting, and as a text for professional accountants and financial executives" (p. viii).

Overall, the authors have accomplished their objective of writing a supplementary text for accounting courses. But the book's usefulness to professional accountants and financial executives is likely to be limited due to its brevity and, at times, rudimentary nature.

The book consists of seven chapters and an epilogue. Study questions and additional references are supplied at the end of each chapter. The questions should prove useful not only for reviewing the chapter, but also for discussing the rationale underlying corresponding *domestic* accounting practices.

The first two chapters provide an overview of international financial accounting. They identify environmental influences, describe the standard-setting process and the organization of the accounting profession in various countries, highlight some accounting problems unique to multinational enterprises (MNEs), and point out the need for international harmonization. These topics should enrich class discussions in both introductory and theory courses.

The next two chapters cover differences in the determination of income and the valuation of assets among several countries. Problems that such differences pose for MNEs and financial analysis are identified (Chapter 3), and various methods used to account for the impact of inflation are reviewed (Chapter 4). These subjects are well suited to supplement intermediate and theory courses.

The coverage of financial reporting by MNEs (Chapter 5) is somewhat uneven. Strong points include the analysis of international differences in disclosure practices, reporting on forecasts, and social accounting. Also the treatment of segmental disclosures in various countries goes beyond what is typically found in intermediate and advanced accounting books. But the exposition on accounting for foreign currency transactions, the translation of financial statements, worldwide consolidations, and the equity method hardly qualify as "supplemental" reading. Most advanced accounting texts cover these topics in greater depth and with more precision. For example, forward exchange contracts are introduced, but the accounting for different types of such contracts is not provided; the notion of functional currency, which is crucial to an understanding of SFAS 52, is mentioned, but the problems of determining a foreign subsidiary's functional currency have been omitted; and the comparison of the temporal with the current rate translation method (Exhibit 5.3) may mislead students since the exhibit uses a combination of historical and average rates in translating the cost-of-goods-sold section in the "current rate" alternative, whereas SFAS 52 calls for the average rate.

The discussion of international aspects of managerial accounting (Chapter 6) should give the readers an appreciation of the complexities introduced into planning, budgeting, product costing, and performance evaluation when a company faces changes in exchange rates and differential rates of inflation. Apart from the brief reference to Sec. 482 of the Internal Revenue Code in connection with transfer pricing problems, the book omits other intricacies of international taxation.

The final chapter deals with international internal and external auditing, the Foreign Corrupt Practices Act, multinational accounting firms, and several efforts to harmonize auditing standards and procedures among countries. Since audit textbooks largely disregard international aspects, this chapter should provide interesting supplemental readings and enrich class discussions.

To the extent that a small supplement can be written to internationalize an entire curriculum and not just a single course, the authors have to be commended for highlighting various international aspects of accounting. Maybe the American Assembly of Collegiate Schools of Business will pick up on the use of texts such as this and will be more forceful in encouraging the internationalization of accounting curricula.

KONRAD W. KUBIN
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Virginia Polytechnic Institute and State University

KATHLEEN RANNEY BINDON, *Inventories and Foreign Currency Translation Requirements* (Ann Arbor: UMI Research Press, 1983, pp. ix, 145, $39.95).

Accounting for foreign currency translation is a complex technical issue. It became an accounting nightmare for multinational enterprises (MNEs) that have substantial investments in overseas business ventures in the early 1970s, when the floating exchange rate system began to spawn volatile fluctuations in foreign exchange rates. Consequently, the accounting profession has been baffled by the problem of how to measure and present the financial positions and the results of foreign operations of these MNEs in a manner that is useful to investors and creditors.

Bindon focuses on the inventory account with two major research objectives: "to determine whether the issuance of *Statement No. 8* had an impact on the inventory management practices of U.S. multinational firms; and to determine the effect on reported earnings due to the change in the foreign currency adjustment as a result of translating inventory at the historical rate" (p. 65). The book is a revision of her doctoral dissertation, completed at Pennsylvania State University in 1981.

The author used a questionnaire survey with telephone follow-ups. Of the 150 largest U.S. MNEs (in terms of foreign sales as of 1978) to which the questionnaire was mailed, 78 responded. The results of the study are documented and concisely tabulated, showing: the translation methods used both for external and internal reporting purposes prior to and subsequent to the issuance of *Statement No. 8* as well as the preferred method; the methods used to determine exposure to foreign currency fluctuations; opinions on the *Exposure Draft*; the effect of accounting requirements on foreign inventory management practices; and the impact of measurement differences in translating inventories at historical versus current exchange rates (the inventory translation difference) on earnings and other financial statement accounts.

The study is exploratory in nature. It does not examine some of the major questions on foreign currency translation of inventories such as the inventory translation difference for the LIFO inventory method, the impact of measurement differences on gross margins, and the relation between accounting for foreign currency translation and for price level changes. But the book is well written and provides a good summary of accounting theories and official pronouncements on foreign currency translation as well as prior research studies on the descriptive, managerial, and capital market effects of *Statement No. 8*. Thus, it can be recommended as a supplementary reading material for research-oriented accounting courses, primarily at the graduate level.

MAMORU YOSHIDA
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Florida Atlantic University

JOHN S. HUGHES, *A Contract Perspective on Accounting Valuation*, Studies in Accounting Research No. 20 (Sarasota: American Accounting Association, 1984, pp. viii, 92, $10.00 paper).

This monograph is concerned with the valuation of certain classes of contracts, securities, and assets. Recent work in finance that builds upon option pricing theory makes it possible to obtain explicit formulas for the valuation of many complex securities—such as convertible debt with a call provision. This monograph sketches the derivation of many of these formulas and attempts to draw implications for accounting valuation and for the nature of financial contacts. For example, the author points out that the accounting valuation of debt ignores the existence of a call provision—whereas the theoretical valuation formula borrowed from finance reveals that the market value of the debt will be affected if the firm can call in debt prematurely.

The monograph is not intended to be a tutorial on the mathematics of option pricing (or contingent claims analysis). Indeed, the mathematics will likely be incomprehensible to those who are not already familiar with the literature.

The author's discussions of the accounting implications, however, generally will be understandable even to those without any knowledge of the relevant literature in finance. This is because most of the accounting implications could have been drawn without deriving explicit valuation formulas. For example, most of us (including practicing accountants) realize that the market value of debt is affected by a call provision. Accountants, however, have had no satisfactory way to measure the impact of a call provision on market value. In principle, the valuation formula in the manuscript could be used to resolve this measurement problem, but the author (perhaps wisely) refrains from making such a suggestion.

One of the three parts of the monograph is concerned with conflicts of interest between stockholders and debtholders. In that section, arguments that have been made fairly loosely in the agency theory literature concerning the strategies stockholders might adopt to expropriate bondholders' wealth are formalized. This thread is followed in the last part of the monograph where the wealth transfer effects of unanticipated changes in accounting rules on accounting-based debt covenant restrictions are formalized.

Those who would like a simple, easy-to-understand introduction to and review of the option pricing literature will be disappointed with this monograph. Those who would like to know how useful the valuation formulas might be in practice are likewise going to have to look elsewhere. Crucial questions such as, "How accurate are these models empirically?" are simply not addressed in the monograph. The monograph is likely to be most useful to those who already are familiar with the relevant literature and who would like a handbook that summarizes that literature using consistent notation. The monograph also provides a coherent framework for evaluating aspects of current practice, and should be a standard citation for those who are doing empirical work on bondholder/stockholder conflicts.

ERIC W. NOREEN
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ROBERT W. INGRAM and RONALD M. COPELAND, *Planning and Control of Municipal Revenues and Expenditures* (New York: National Association of Accountants, 1984, pp. ix, 84, $8.95 paper).

This research study, supported by the National Association of Accountants, demonstrates the potential role of variance analysis in evaluating a municipality's financial policies and revenue and expenditure patterns. Since categorizing each city according to socio-demographic attributes is critical to this evaluation, the authors also explain how this can be accomplished through the use of cluster analysis.

Following an overview of the study's research methods, findings, and potential benefits, the authors provide a brief review of related literature. Drawing on theoretical developments by Downs in *An Economic Theory of Democracy* [Harper, 1957] and Tiebout in "A Pure Theory of Local Expenditures" [*Journal of Political Economy*, 1956], the authors posit that socio-demographic attributes should be helpful in identifying cities with similar revenue and expenditure patterns. Once properly classified, a city's revenue and expenditure patterns can be compared against group norms, thus allowing an evaluation of financial policy and performance variances.

Using data provided in the *City-County Data Book* (Bureau of the Census) on a sample of 780 cities, the authors experimented with 15 variables measuring income, municipal economics, and city demographics. Two variables, per capita personal income and percentage change in per capita personal income (growth), were found to "be as useful for separating the sample into statistically different groups as any other combination" (p. 17). Thus, cluster analysis employing these two variables was used to categorize the cities into four groups according to two dimensions: high and low per capita income and high and low growth. Based on Downs' and Tiebout's theories that cities with similar socio-demographic attributes should face similar resource needs and demands for services, these groups were then used to analyze revenue and expenditure patterns.

Based on data from *City Government Finances* (Bureau of the Census), 21 revenue and expenditure ratios were calculated for each city using total revenue as the denominator. As expected, differences were observed across groups for most ratios. Furthermore, the ratios appeared to be relatively stable within each group and across time for the 1973 to 1979 test period. The stability of these ratios and an understanding of their relationships should enable city officials to compare their financial policies with group norms and more accurately project future revenues and expenditures as a percent of total revenue. Proper application of these techniques could lead to improved municipal financial planning and control.

Variance analysis appears to be a plausible approach for city officials to use when evaluating financial priorities and their ability to execute a financial plan. By comparing the actual proportion of total revenues expended on particular functions with the average proportion expended by cities with similar socio-demographic characteristics, variances from the "norm" become apparent. As in the private sector, these variances must be interpreted with great care. In addition, the interpretations must recognize that the "group norm" does not represent a "standard," but merely is the average level of expenditure by cities with similar economic constraints but perhaps with different financial conditions. In any case, internal comparisons between actual and planned revenues and expenditures should provide a basis for assessing the causes of variances and for modifying performance. The utility of variance analysis is amply demonstrated in the final chapter.

In the past, municipal accounting information has been viewed primarily from a legal compliance perspective. The authors hope that this study will stimulate the use of this information as a management decision tool to improve planning and control of municipal finances. They argue that this is not only of concern to public administrators, but should be of interest to private firms and voters who are directly affected as service recipients and taxpayers. They add that these constituents have the power to alter economic behavior and to insist on the use of appropriate planning and control techniques.

This study will be of interest to practitioners and academics concerned with municipal financial planning and control. It could be used in an undergraduate or masters-level governmental accounting course to demonstrate the use of managerial accounting techniques in the public sector or as a research study to be critiqued in a doctoral seminar.

ROBERT W. PARRY, JR.
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LARRY N. KILLOUGH and WAYNE E. LEININGER, *Cost Accounting: Concepts and Techniques for Management* (St. Paul: West Publishing Co., 1984, pp. xxii, 850, $29.95).

An advertisement for this book begins "Not just another cost accounting text . . . but a cost accounting text that offers students hands-on computer experience." This book lives up to its advertisement. In addition to being a typical cost accounting textbook for third- or fourth-year accounting majors, this volume may be used to integrate microcomputer electronic spreadsheets into the cost accounting curriculum. It also may be used in the conventional manner, that is, the microcomputer applications are not intrusive and the book can be used satisfactorily in a traditional cost accounting course. The entire discussion of electronic spreadsheets is contained at the end of the book (Appendix A, pp. 773–825).

The inclusion of a section on using electronic spreadsheets is a unique feature of this textbook. (Other publications illustrate how electronic spreadsheets may be used to solve cost accounting problems, but they are not cost accounting textbooks in the traditional sense.) Also available is a diskette for students to use to solve end-of-chapter problems with one of three electronic spreadsheets (VisiCalc, Lotus 1-2-3, or SuperCalc) on either the IBM-PC, Apple IIe, Apple II Plus, or TRS-80 computer.

Appendix A, on the "Use of Electronic Spreadsheets," is intended to introduce students to spreadsheets in general and the three spreadsheets mentioned above in particular, as well as the rudiments of microcomputer operation and the use and design of templates. This was a difficult task considering the allotted space, but the authors accomplished it reasonably well.

The utility of electronic spreadsheets for solving cost accounting problems is readily apparent from the diskette. All problems in cost accounting can be solved with the aid of an electronic spreadsheet. (This includes purely verbal problems, since all electronic spreadsheets have a word processing capability.) The diskette includes 21 templates, which may be used without modification to solve about 60 of the end-of-chapter problems. Students are encouraged to develop their own templates and solve additional problems. The authors, however, do not always take full advantage of the capability of electronic spreadsheets. At one point they follow the lead of several other cost accounting textbook writers by including a BASIC language program for solving a reciprocal services cost-allocation problem on a large computer [pp. 174–176]. The student is assumed to know BASIC and be familiar with and have access to a mainframe or minicomputer. A more consistent approach would be to include another spreadsheet template on the accompanying diskette for solving this problem on a microcomputer.

The 22 chapters provide a broad coverage of most cost accounting topics including cost terminology and behavior, estimation methods, job and process costing, special cost allocation problems, budgeting, standard costs, C-V-P analysis, and linear programming. Sufficient material is provided for an entire academic year, especially if students are expected to use the microcomputer to solve problems and have had little prior experience using electronic spreadsheets. Alternatively, the book is flexible enough to permit the instructor to use selected chapters in a one-semester course.

The sections of the book pertaining to quantitative methods are written clearly and contain more detail than usually is found in similar books. The learning curve chapter goes so far as to include logarithm tables and a review of how to use them. While discussion of the logarithm tables is useful and unique, many students now have inexpensive calculators that can be used to compute logarithms directly. Calculators also can be used to compute power functions directly, that is, values of any number raised to any power (within the limits of the calculator). This greatly simplifies learning curve calculations, but the use of calculators is not discussed in this and most other texts. Another omission is the lack of an electronic spreadsheet template to solve learning curve problems.

Each chapter includes a comprehensive review problem and its solution, and a large number of diverse problems, cases, and exercises—many of which were adopted from the CPA and CMA examinations. Also available are a solutions manual, an instructor's manual with a test bank (revised), and a student study guide. The first printing of the textbook, the solutions manual, and the study guide had numerous errors. The publisher has distributed errata sheets to accompany all of these publications.

In summary, this book is recommended primarily to instructors at the undergraduate level who wish to use its microcomputer features. In spite of a few deficiencies, other potential adopters should consider this text along with the other current offerings.

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SHANE MORIARITY and EDWARD JOYCE, Editors, *Decision Making and Accounting: Current Research* (Norman: The University of Oklahoma, Center for Economic and Management Research, 1984, pp. iii, 217, $14.95 paper).

This book contains the proceedings of a conference held at the University of Oklahoma in December 1983. In the foreword the editors indicate that the papers were chosen, in part, for their diversity and that they instructed the discussants to emphasize avenues of further research. The editors also state that their intent was to stimulate new ideas, particularly for graduate students. The proceedings reflect exactly these characteristics.

Seven papers are included in the proceedings along with two discussant's comments on each and a short summary article by Edward J. Joyce on "The Implications of the Information Processing Paradigm for Decision Research in Accounting." The seven papers are diverse with no two of them on the same topic. The list of topics includes: confidence in causal reasoning, schematic models, cognitive style, calibration of subjective probabilities, conformance with the independence axiom, process tracing, and expert systems. Diversity also was achieved on other dimensions. Three of the papers reported the results of original experiments (causal reasoning, cognitive style, and conformance with the independence axiom), another three summarized past studies and the current problems in the field (calibration of subjective probabilities, process tracing, and expert systems), and yet another presented a cognitive model of auditor opinions (schematic models).

The discussants did an admirable job in both constructively criticizing the work and in indicating directions for future research. This kind of review is invaluable for graduate students. The student gets to hear what other noted experts think about the work and where the critical issues lie. In fact, many of the articles are ideal as introductory pieces on a given topic. The reviews of the topics in the papers are sufficiently short and well written to expose the novice to the major ideas and shortcomings of the research without overburdening the reader with details. Each paper also has a sufficient bibliography so that the interested reader can get started learning more about a given topic.

For readers with more experience on a given topic the papers also are valuable, particularly when coupled with the discussant's comments. Each topic has much food for thought.

This volume is worthwhile reading for both the experienced researcher and the novice. It achieves what the editors and organizers of the conference intended.

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JOHANNES M. PENNINGS, Editor, *Decision Making: An Organizational Behavior Approach* (New York: Markus Wiener Publishing, Inc., 1983, pp. viii, 391, $18.00 paper).

This book is a set of readings on decision making in organizations. It is based more on an organizational view of decision making than on the individual information processing approach reflected in current research in auditing and managerial accounting. It departs dramatically from the organizational models implicit in much of accounting theory by presenting discussions of models of organizations and organizational choices based on contingency, social process, and political theories rather than micro-economic theory. Its expressed purpose is to provide a set of readings that reflect current thinking on micro-organization behavior, macro-organization behavior, and strategic decision making. Its primary contribution is that it is a good collection of readings reflecting recent thought in organization behavior and design.

The book is divided into three distinct parts. The first part builds heavily on expectancy theory and social processes (*a la* Weick) as appropriate contingency theories to describe job-related choice behavior such as motivation. The second part includes papers using various forms of contingency theory to explain the interaction of decision making and organization designs. The third part contains articles on various contingent models of choice behavior in strategic decision making. The focus in the third part is on notions of bounded rationality; sequential, incremental, or partitioned decision making; and decision heuristics in an organization theory context.

The book is a useful collection of readings that instructors might use in one of three types of courses. First, it might be used in a traditional management planning and control systems course patterned after the Anthony, Dearden, and Bedford text. In this type of course, the instructor would have to spend a significant amount of class time bridging the gap between these readings and management control system issues. Second, it might be useful in a Ph.D.-level course in managerial accounting that devotes a significant amount of time to control issues. But for both of these courses, the scope of the book is too narrow to comprise a complete set of supplementary readings, and the instructor is unlikely to assign most of the readings if the material is to be supplemented with other outside readings. Third, it might be used in a Ph.D.-level course devoted to organizational issues in accounting. The book provides a useful, albeit incomplete, set of articles for this type of course. It still would need to be supplemented with appropriate readings from accounting and other source literatures.

In summary, the book provides a useful set of readings on organizations and decision making at the group or organization level of analysis, but is too narrow in scope to be used as a supplementary text in most accounting courses.

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JAMES W. PRATT, JANE O. BURNS, and WILLIAM N. KULSRUD, Editors, *Federal Taxation: 1986 Edition* (Houston: Dame Publications, Inc., 1985, pp. xxvii, 1,622, $31.95).

JAMES W. PRATT, JANE O. BURNS, and WILLIAM N. KULSRUD, Editors, *Individual Taxation: 1986 Edition* (Houston: Dame Publications, Inc., 1985, pp. xxvii, 1,178, $29.95).

The first of the two books is a comprehensive text that covers taxation of individuals as well as corporations, partnerships, and fiduciaries. This is its third edition. The 1984 edition was introduced too late in 1983 for fall adoptions. The 1985 edition was the first serious entry into the market and the 1986 edition is the first major revision.

The second of the two texts has contents identical to the first 16 chapters of the comprehensive volume covering topics related to taxation of individuals. It has only one additional summary chapter on the tax treatment of C and S corporations and partnerships. But it has a companion volume that covers these topics and fiduciary taxation in depth. While both of these separate volumes are in their second edition, this is the first year that both are available for fall adoption.

The organization and presentation in these texts is quite similar to that of the West series, but with certain differences. First, while the 1985 edition contained some errors, the authors have made a number of corrections for this edition. They seem to be following through on their promise to be more responsive to the complaints of adopters. The same also can be said of the errors in the solutions in the instructors' manuals which accompany the texts.

Next, the 1986 edition includes extensive revisions which incorporate the changes in the tax laws made by the Deficit Reduction Act of 1984. The most encouraging part of these revisions is that the authors rewrote most of the applicable sections of the text rather than simply inserting new sections within the old text material. As a result, the continuity and readability are maintained in this new edition. The only criticism of the authors' method of revision is that occasionally they deleted too much of the detail of the old law which may still be applicable—for example, the alimony provisions for pre-1985 agreements.

The comprehensive volume is most suited to a three-quarter sequence or a five-credit, one-semester course which emphasizes individual taxation. The individual tax material generally is too extensive for a three-credit, one-semester course, while the chapters on corporations, partnerships, and fiduciaries are somewhat condensed for a full semester. But the separate corporate volume provides expanded coverage adequate for a full semester.

The separate individual volume similarly contains too much material for the typical three-credit, 15-week course. Two or three of the chapters may be omitted, or covered only lightly, to bring the text into manageable limits. The two-volume set provides the best alternative for the typical two-semester, two-course sequence.

Overall, the writing is clear and accurate. Many examples are used to illustrate the various points of the tax law, and there are a number of end-of-chapter questions and problems. One of the major problems with these texts is the lack of teaching aids such as test banks and instructors' outlines. While these may not be important to those who teach income tax courses on a full-time basis, their absence is a definite detriment to the professor who teaches only an occasional tax course. But this is balanced by the completeness of coverage and the text's readability which makes the occasional teacher's job less strenuous.

KAREN A. FORTIN
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CORNELIUS E. TIERNEY and PHILIP T. CALDER, *Governmental Accounting: Procedures and Practices, 1985*, Second Edition (New York: Elsevier Science Publishing Co., Inc., pp. xiii, 321, $75.00).

Governmental Accounting Procedures and Practices (GAPP) is the only comprehensive reference source on local government accounting and financial reporting practice "trends and techniques." It is a unique and useful research source for accounting professors and undergraduate and graduate students, as well as for governmental accounting and auditing practitioners.

The 1985 edition, based on analyses of the annual financial reports of over 700 U.S. cities and counties, is a significant improvement over the excellent 1983 initial edition. As in the first study, Tierney and Calder—both Arthur Young & Company partners with national practice responsibilities—worked with a team of Georgetown University accounting students directed by Professor Mortimer A. Dittenhofer to produce the 1985 GAPP study and report.

The 1985 GAPP volume includes:

- Numerous tables that present quantitative analyses of the contents, accounting policies, reporting formats, and terminology of city and county financial reports, often accompanied by analytical discussions, explanations, and observations.
- Many example excerpts from annual financial reports to illustrate contemporary accounting policies and reporting practices, including notes to the financial statements, with emphasis on both prevailing practices and variations in practice.
- Several special analyses, e.g., of the extent to which local governments have complied with certain newer accounting and reporting requirements prior to their effective dates.

Other special analyses cover the auditor's report and public employee retirement system accounting and financial reporting.

The GAPP text begins with a brief summary of generally accepted accounting principles applicable to local governments, followed by chapters on legal compliance, fixed assets, long-term liabilities, basis of accounting and budgetary accounting, and interfund transactions and bond issue proceeds. After two "operating results" chapters on governmental funds and proprietary funds, respectively, several "balance sheet" chapters cover assets, liabilities, and equities. The remaining chapters are on areas such as reporting changes in financial position, transmittal letters, compliance with newer standards, public employee retirement systems, auditor reports, and selected topics. Many users will be particularly interested in the coverage of newer and emerging topics such as self-insurance, designations, reporting entity, leases, claims and judgments, and compensated absences.

The principal weakness of any research study and report such as this is that the specific attribute or distinction of interest to a user may not have been researched or reported from the perspective that is of concern to that user. The authors recognize this inherent problem and solicit user comments and suggestions for improving future volumes.

GAPP is sufficiently useful that every college and university library should have at least one copy. Too, each professor who teaches governmental accounting or conducts related research should have ready access to a copy to supplement the course textbook, stimulate research, and serve as a research reference source. Many professors also will want to make supplemental reading assignments from GAPP in both undergraduate and graduate courses. Graduate students will find it useful for many research projects, including dissertations.

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WANDA A. WALLACE, *Handbook of Internal Accounting Controls* (Englewood Cliffs: Prentice Hall, Inc., 1984, pp. 463, $45.00).

Professor Wallace is known to many as the author of *The Economic Role of the Audit in Free and Regulated Markets*, a scholarly and thought-provoking exploration of this topic. The volume under review is far different—bulkier, pitched at a lower level, and directed primarily to the practicing profession.

Approximately half of the book is devoted to internal control in general. Among the topics covered are the objectives of the internal control review, the characteristics of good systems (with emphasis on the smaller entity), the techniques used in gathering internal control evidence, the auditor's approach to the internal control review, the management letter, special aspects of free-standing "comprehensive" reviews of internal accounting control systems, and reporting requirements under the Statements on Auditing Standards. In general the treatment is comparable to that provided in auditing textbooks, though more detailed and with numerous examples. But teachers are unlikely to adopt this book for classroom use due to the lack of extension to auditing procedures and other topics. Moreover, members of the practicing profession (the nominal audience for the *Handbook*) are likely to find these general chapters to be too elemental and unfocused for day-to-day reference.

The more specific chapters are of greater potential use to practitioners. These relate to the cycles for revenue, production, financing, and nonroutine transactions, as well as to the special concerns of EDP systems. The author provides checklists, sample forms, and examples of potential problem areas. Teachers may find these chapters useful in developing lectures or test questions.

A concluding chapter presents suggestions for the review of controls in not-for-profit entities, a topic apparently of particular interest to the author. Although illustrations related to a hospital and a church are included, this discussion may be typified as a survey. Not enough detail is provided to enable one to approach a not-for-profit engagement knowledgeably.

The *Handbook* has its strengths. It is technically accurate, clearly-written, and easy to read. The problem is that it does not fill a needed niche. As noted, it is not intended for classroom use, although much of the presentation is at the introductory level; it lacks problems and other instructional aids, and instructors would find its coverage too detailed for use in an introductory auditing course and too elementary for an advanced course. Presumably the *Handbook* would be useful to practitioners as a reference. While some of the specialized chapters might meet this purpose, it is doubtful that practitioners will be pleased with the general topic coverage, which comprises half the book.

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PETER WESNER, *Bilanzierungsgrundsätze im Wertpapierrecht der U.S.A.*, Neue betriebswirtschaftliche Forschung 28 (Wiesbaden, West Germany: Verlag Dr. Th. Gabler, 1984, pp. xvi, 189, DM 48.00).

This book is available only in the German language. Its title is "Principles of Accounting Within U.S. Securities Laws." The relatively short volume is yet another recent example of how others see us.

The key objective of the book is to analyze and interpret U.S. GAAP for West German users of U.S. financial statements. The major conclusion of the author is that a fundamental "principle of objective measurement" (Objektivierung) lies at the core of all U.S. GAAP. Application of this principle limits the judgmental latitude of management in making its accounting choices. It is asserted that a similar management choice limitation exists in West Germany, but there a multitude of corporation/tax laws are the constraining element. The author finds that ranges of permissible accounting choices are virtually the same in both West Germany and the U.S.

The subject matter is presented in three chapters. The first (12 pages) comments on the institutional framework of accounting in the U.S., and provides some historical and environmental perspectives.

The second chapter (50 pages) is devoted to the conceptual content of U.S. GAAP. Various objectives of financial statements are explored and various accounting income determination methods are analyzed. The efficient market hypothesis is presented and various bits and pieces are introduced from information economics as well as the capital asset pricing model literature. Also included is some discussion of the relationship between various management and economic decision models and accounting income determination and asset and liability measurement.

The third chapter (112 pages) analyzes selected specific accounting standards that presently exist under GAAP. The main divisions of the chapter are asset accounting, accounting for liabilities, transaction measurement standards, and depreciation and amortization rules.

The book concludes with a very useful three-page summary.

The most interesting feature of this book is its non-U.S. perspective. For example, the author asserts that the FASB, in its conceptual framework, is seeking a financial reporting system that will serve (in a general-purpose sense) all interest groups and all relevant models (p. 21). Accrual accounting is perceived as a way by which the FASB intends to reach the "general purpose" goal.

We also are told that the fundamentals of the author's "principle of objective measurement" clearly point toward an asset and liability view within U.S. GAAP (p. 61). The revenue and expense view thus becomes subordinate. At another point the author observes that the entire GAAP literature is silent as to the specific function to be served by the historical cost principle (p. 135).

What are some noteworthy dimensions of this book? One is the author's conclusion that the judgmental latitude allowed management in the choice of accounting principles to be used is similar between West Germany and the U.S. The theory chapter also is a plus. It provides a wide overview of the current conceptual/theoretical accounting scene in the U.S.—and all within 50 short pages. Finally, the accounting principles selected for specific analysis in Chapter 3 include the more interesting ones, e.g., research and development, leasing, deferred credits (as in comprehensive income tax allocation), and the lower-of-cost-or-market rule.

As with most comparative works, the book has a number of flaws and outright errors. For instance, in the theory chapter, the author treats APB Statement No. 4, all of the FASB's conceptual framework statements, and Beaver's *Accounting Revolution* as though they were integral parts of GAAP. This is patently not the case! Also, key elements of GAAP (e.g., the fair presentation doctrine and the consistency requirement in periodic reporting) are not covered at all. Finally, the book has a number of misstatements. For instance, the author states literally that the FASB is about to decide whether it will subscribe to the asset and liability view, or the revenue and expense view (p. 61). I am unaware that such a decision is about to take place!

This book is a "lightly edited" 1983 accounting Ph.D. dissertation prepared under the guidance of Professor Adolf Moxter at Goethe University in Frankfurt. Most of Professor Moxter's writings reflect traditional views of financial accounting and reporting. For example, he states in his foreword to the book that "unequivocal financial accounting standards can derive only from unequivocal statutory accounting objectives." All along, Professor Moxter has been rather critical of U.S. GAAP.

This work uses *a priori* reasoning. Its nature and content are reminiscent of Accounting Research Studies Nos. 1 and 3, and Storey's *Search for Accounting Principles*. In a comparative and evaluative sense, the book makes a positive contribution to international accounting literature. It adds little to state-of-the-art financial accounting research in U.S. libraries, but scholars interested in German contributions to the financial accounting literature might add this volume to their collections. General usefulness of the book in U.S. settings is decidedly limited.

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STEPHEN A. ZEFF and THOMAS F. KELLER, Editors, *Financial Accounting Theory: Issues and Controversies*, Third Edition (New York: McGraw-Hill Book Co., 1985, pp. xi, 660, $19.95 paper).

Over the years the scope and definition of financial accounting theory have expanded from an almost exclusive emphasis on the measurement of income to include the economic issues underlying the complex legal, political, sociological, and psychological environment in which accounting exists. Such a pervasive and dynamic topic is not easily captured within the framework of a traditional textbook. One approach is to periodically prepare a book of readings which reflects the essence of the accounting literature at important junctures of its historical development. To be successful, such a strategy must produce editions that coincide with significant shifts in the accounting literature as well as, at each point in time, provide a parsimonious set of integrated readings which can be understood by the bulk of accounting educators and students. In this reviewer's opinion, Zeff and Keller have continued to successfully execute such a strategy with this, their third edition (the two previous editions were published in 1964 [reviewed October 1964, pp. 1122–1123] and 1973 [reviewed October 1974, pp. 894–896]).

This edition, which contains none of the articles of the two earlier efforts, reflects four areas of interest in the accounting literature that have become evident since the publication of the 1973 work: (1) the standard-setting process, with particular emphasis on the role of "economic consequences" as they relate to the lobbying behavior of interested parties; (2) the role of objectives and the search for a conceptual framework; (3) the expansion of accounting disclosures; and (4) the recent emphasis on cash flow accounting.

For the most part, the book is organized from general to specific. The first six sections, roughly half the book, deal primarily with broad conceptual issues. Included in this segment are individual sections containing readings which cover the four topics mentioned above, a group of readings concerned with management's choice of accounting methods, and a section covering the preferability and uniformity issues. Section 7 contains articles concerned with 14 relatively specific and controversial accounting problem areas: allocations, revenue recognition, inventory, commitments and future resources, interest capitalization, research and development, corporate diversification and intercorporate investments, income taxes, contingencies and forecasting, liabilities, leases, pensions, stock options, and accounting changes. The final two sections, 8 and 9, seem to deviate somewhat from this pattern of general to specific by returning to two rather broad conceptual issues: the impact of changing prices on accounting and accounting alternatives, and the capital market.

The strengths of this edition are in three areas. First, the readings capture the essence of contemporary accounting thought in a reasonably parsimonious fashion. Most of the articles are concerned in one way or another with the economics of financial reporting rather than technical or purely theoretical measurement issues. I agree with the editors that "economic consequences" underlying both the standard-setting process and the choice of accounting methods by management are crucial in characterizing the last ten years in the accounting literature. Further, over the same time period, discussions of the conceptual framework project, the expansion of required disclosures, and cash flow accounting have generated much attention in both academic and professional journals.

The second area of strength is the integration of the topics as well as the rich historical and international perspectives provided by the editors. For example, the articles in Section 7, devoted to the relatively specific controversies in accounting, almost without exception call upon the general concepts developed in earlier sections of the book. The editors also provide an introduction to each of the nine sections (as well as to each of the controversial areas discussed in Section 7) which, in most cases, provides an interesting and lucid historical background as well as a discussion of similar concerns in countries other than the U.S. Combined with the editors' rationale for the choice of each article in the section, these historical and international perspectives create a well-integrated and cohesive train of thought. The introductions to the sections dealing with standard setting, the conceptual framework, and changing prices are particularly well done in this regard.

Finally, the editors have succeeded in providing a set of articles that not only cover the important areas of current accounting thought but, at the same time, are understandable to the overwhelming majority of accounting educators and students. In general, the articles, which come primarily from the *Journal of Accountancy*, THE ACCOUNTING REVIEW, and various professional periodicals, are intuitive, interesting, and not laden with academic jargon and statistical analysis. Thus, a number of the readings could be used to supplement the textbook as early as the first intermediate accounting course at either the graduate or, especially, the undergraduate level. Perhaps the book could be used best as the primary text in an advanced course in accounting theory at the undergraduate level.

While this book of readings certainly has a number of strengths, it also has several limitations. It would not be appropriate, for example, as a primary text for an upper-level masters course or, especially, a doctoral seminar. Clearly, some of the articles could be used to introduce certain contemporary accounting issues to students interested in research but, for the most part, the readings are neither precise nor careful enough to represent satisfactory academic rigor. Further, the major research approaches in accounting are neither well illustrated nor adequately discussed. Behavioral research and information economics are virtually ignored and the introductions to the very limited sections on management accounting choices and capital markets are somewhat superficial and not well integrated into the rest of the material. In fact, the section on capital markets, along with the section on changing prices, seems to be "tacked on" at the end rather than integrated with the other, more general issues in the front half of the book. Certainly, the editors did not intend to provide a synoposis and evaluation of accounting research. But at least an intuitive discussion and integration of the main research perspectives (e.g., behavioral, information economics, capital market, and positive research) with a selection of illustrative articles would have provided a richer coverage of financial accounting theory.

While the choice of important topics for a book of readings is a matter of opinion, I believe that two additional areas are important enough to have warranted greater attention. The role of the auditor in the financial reporting process is not explicitly covered in the readings. The economics of the financial reporting process cannot be disentangled from such issues as the increasing level of audit liability, the negotiation process between auditors and managers, and the role of auditors in the standard-setting process. Granted, the selected readings implicitly cover some of these issues, but this coverage is somewhat *ad hoc* and neither well-integrated nor well-developed. A separate section devoted to these issues would have been helpful.

Similarly, while the introductions to some of the sections as well as some of the readings deal with practices in countries other than the U.S., no section is devoted exclusively to the problems of international standard setting. Certainly, much of the accounting literature in the last ten years has concerned itself with international standard-setting bodies, the harmonization of accounting standards, and the role of culture and environment in explaining financial reporting systems. One could argue rather convincingly that in today's multinational environment, such issues could well be included in a complete discussion of financial accounting theory.

In summary, notwithstanding these limitations, there is little doubt that this book of readings achieves its stated objective "to provide institutional and historical perspective to contemporary financial accounting controversies, as well as supply a lively dialogue on accounting theory for future accounting professionals and others interested in corporate financial reporting" (p. ix). It represents the third of a series of readings books which, for the most part, have captured the important issues in contemporary accounting thought with a well integrated, reasonably parsimonious, and understandable set of articles.

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CAPSULE COMMENTARIES

Harvey S. Hendrickson, Editor

JAMES RING ADAMS, *Secrets of the Tax Revolt* (San Diego: Harcourt Brace Jovanovich, Publishers, 1984, pp. xiii, 402, $16.95).

This book attempts to trace the roots of citizen tax revolts in eight states (Massachusetts, New York, California, Ohio, Michigan, Louisiana, Texas, and New Hampshire). The author, a member of the Editorial Board of *The Wall Street Journal*, takes the position that fiscal prosperity is engendered through adherence to supply-side economic policies. He posits that this lesson has developed over three phases. In the first phase (embodied in 18th-century Massachusetts), the citizens demanded taxation with representation. In the second phase (19th-century New York), the citizens refined representation to include direct majority consent through referendum requirements for bond issues. In the third phase (20th-century California), the citizens learned to bypass representative consent by voting directly on initiative proposals such as Proposition 13. After expounding on the conditions that precipitated such movements, the author presents six modern-day case studies (OH, MI, LA, TX, NH, and MA) to illustrate his proposition that tax increases wreck economies while tax decreases revive them.

The conclusions drawn by the author after his case analyses can be stated as follows:

1. The magic formula for economic growth is "falling tax burdens and rising technologies" (p. 338).
2. "Forget the special breaks for business. Lower the personal tax burden" (p. 339). This coincides with the author's belief that economic policies should favor entrepreneurs, not large corporations.
3. "Tax cuts are not everything" (p. 340). Some public services (police, fire, and education) must be maintained.

This book is heavy on history (and on geological similes) but light on economics. The author tends to focus more on people (e.g., Nelson Rockefeller, Huey Long, Ronald Reagan) than on economic theories. This book will be received most favorably by those who share the author's economic ideologies.

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LEOPOLD A. BERNSTEIN, *Analysis of Financial Statements*, Revised Edition (Homewood: Dow Jones-Irwin, 1984, pp. xi, 381, $25.00).

This is a shortened version of Bernstein's *Financial Statement Analysis: Theory, Application, and Interpretation*, Third Edition (see the immediately following review). Its objective is to present a current treatment of financial statement analysis for decision makers. An understanding of accounting is assumed, and so this version includes only part of the complete text: the first chapter (on the efficient market hypothesis and portfolio theory), the fourth chapter (on the overview of analysis techniques), all eight chapters (on analysis techniques) from Part III, and Chapter 15 (on the auditor's report) from Part II as an appendix. As in the third edition, Bernstein uses the first chapter to challenge the implications of portfolio theory and the efficient market hypothesis, and to promote the values of the analysis of individual securities. The second chapter is the preview of the tools and techniques of financial statement analysis covered in the remaining eight chapters. The appendix discusses the auditor's opinion. This version includes the questions at the end of each chapter, but no problems.

This book would be most appropriate for accounting majors at either the graduate or undergraduate levels who have a good knowledge of financial accounting and can move directly into the analysis techniques.

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LEOPOLD A. BERNSTEIN, *Financial Statement Analysis: Theory, Application, and Interpretation*, Third Edition (Homewood: Richard D. Irwin, Inc., 1983, pp. xxii, 927, $31.50).

The third edition of Bernstein's book still is the best text available on traditional financial statement analysis. This edition contains the same 23 chapters as the previous (revised) edition (reviewed January 1979, pp. 243–244).

Bernstein stresses the importance of understanding. Decisions require sound information and the ability to forecast. "Sound information is obtained by an *understanding* of the data from which it is derived" (p. ix), and foresight also is rooted in an understanding of the data. It is significant that the author is a professor of accounting and a consultant to both accountants and analysts. The text provides the material for understanding the accounting data and the analysis methods in three sections.

The first section contains the only change in the chapter order from the previous edition: What was the third chapter is now the first. This chapter includes discussions of the efficient market hypothesis, which implies that statement analysis is worthless, and of portfolio theory, which places emphasis on movements of the market as a whole and on diversification. Bernstein's arguments against these implications and for the analysis of individual securities should convince most students and other readers of the value of studying financial statement analysis. Addressing this issue in the first chapter is a definite improvement because it gives positive motivation for learning the material covered in the remainder of the book.

The second section includes ten chapters on the principles and procedures of financial accounting plus a chapter on the meaning of the auditor's opinion.

The third section contains the measures and techniques of financial statement analysis. The organization of this section is based on six "building blocks" of financial analysis. These chapters may be studied together as the last part of the course or they may be covered individually with corresponding chapters in the second section.

This edition is longer than the revised edition because it has more exhibits and diagrams illustrating ideas in the narrative, the main set of financial statements found in Appendix 4B is more comprehensive, and the chapters in Part II have been expanded to include new pronouncements on accounting and auditing standards. This edition also is longer because the text includes not only the odd-numbered problems but also the even-numbered problems that previously were included in the instructor's manual.

Two other features of Bernstein's book that have been enhanced in the third edition are the emphasis on the limitations of accounting and the questions and problems. Starting with the second chapter, the reader is made aware of the limitations of accounting and the opportunities for manipulation, such as income smoothing, that are possible within the guidelines of GAAP. This theme is continued throughout, especially in the "Implications for Analysis" discussions.

More questions and problems are based on comprehensive annual reports and a greater variety of topics is covered in the other problems. Adequate assignment material is provided.

In summary, Bernstein achieves his goal of providing a comprehensive, current coverage of financial accounting that will enable users to understand the data they are analyzing. He presents an array of analysis tools and techniques. Accountants, security and credit analysts, investors, creditors, and teachers and their students at both the graduate and undergraduate levels who are not likely to be accounting majors should benefit greatly from the use of this book.

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D. R. CARMICHAEL and JOHN J. WILLINGHAM, *Perspectives in Auditing*, Fourth Edition (New York: McGraw-Hill Book Co., 1985, pp. viii, 503, $17.95 paper).

The objective of this updated readings book is to supply materials not provided in standard auditing texts. The book is intended for use as a supplemental text for an undergraduate auditing course or a primary text for a graduate course. In general, the book meets these goals.

The current edition has 53 articles, three more than the third edition (reviewed January 1980, pp. 203–204). The articles are grouped into 14 chapters, each of which includes an introduction describing the topic and how the readings relate to it. Eight or more open-ended review questions are provided at the end of each chapter. The articles' original publication dates range from 1932 to 1985 with 21 being from 1980 or later. Among the 27 articles new to this edition are ones dealing with computers and auditing, internal auditing, governmental auditing, SEC regulation, and peer reviews.

The major strength of this book is the broad range of topics covered. Combined with the chapter introductions and review questions, the articles provide a basis for exploring many of the most important issues facing auditors today. The only significant deficiency is the absence of recent articles dealing with auditors' legal liability and the role of audit committees.

In summary, the latest revision of this book continues to be an excellent means of providing students with a better understanding of several complex auditing issues. Instructors of undergraduate courses will find the book to be more than sufficient for supplemental reading assignments. Instructors of graduate courses probably will find the book to be a useful starting point for exploring the issues, but may wish to make additional reading assignments to achieve greater depth of coverage. The book is recommended for use at both levels.

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John J. Clark, Thomas J. Hindelang, and Robert E. Pritchard, *Capital Budgeting: Planning and Control of Capital Expenditures*, Second Edition (Englewood Cliffs: Prentice-Hall, Inc., 1984, pp. xii, 563, $32.95).

This text is geared for senior-level undergraduates through the Ph.D. It is a very complete treatment of capital budgeting. The book has been revised extensively from the first edition (reviewed July 1980, p. 529 and April 1981, pp. 415–416) and incorporates the most recent contributions to capital budgeting in a systematic and comprehensive manner.

The book is partitioned into modules to enable instructors to use parts of the book in an orderly and integrative way with students of various levels of mathematical and statistical sophistication. The modules are set up so that students with little or no knowledge of the concepts of capital budgeting, including the time value of money, can learn the topics in a building-block fashion.

The treatment of capital budgeting is as complete a coverage of the topic as I have seen. The basic models of net present value, internal rate of return, and the profitability index are introduced and compared. The treatments of the relevant tax aspects of capital budgeting as well as of leases from both the lessor and lessee perspective are excellent. The module on the Capital Asset Pricing Model and the determination of the cost of capital is complete and well done. For those who have had an introduction to linear, integer, and goal programming, the section on multi-period analysis also is well done. The list of references is very comprehensive.

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Robert F. Cushman and Herbert A. Morey, Editors, *A Guide for the Foreign Investor: Doing Business in the U.S.A.* (Homewood: Dow Jones-Irwin, 1984, pp. xviii, 603, $45.00).

This book is a collection of contributions by some 40 different authors designed to alert the foreign investor to the key procedural and compliance requirements and other business issues that are likely to be encountered when making either a direct or indirect investment in the United States. It has 25 chapters that are grouped into eight parts. Coverage is provided on general subject areas such as planning, the banking system, the legal system, the taxation system, and labor law and employment practices that are of interest to foreign investors. Separate chapters are provided on the specialized areas of real estate, construction, mass communication, and insurance.

Part IV of the book examines U.S. tax and accounting rules. It is divided into four chapters—three of which are tax-related. The tax chapters examine the U.S. tax laws concerning starting a business in the United States (e.g., branch versus subsidiary), acquiring a business in the United States (e.g., taxable versus tax-free acquisitions), and the federal taxing system. The book does not include the changes that were made in the 1984 Tax Reform Act. As a result, some portions of the book are out of date (e.g., Domestic International Sales Corporations) and some materials are not included (e.g., Foreign Sales Corporations). The financial accounting chapter is only 18 pages. In it the authors attempt to present basic coverage on the role of organizations such as the SEC and FASB, the auditing function, the basic financial statements, selected accounting principles, and the accounting requirements for public and private companies.

Part IV follows a pattern that is typical of the book's other parts. It is written at an introductory level that should appeal to a wide variety of readers. A person who has little information about the U.S. or its business practices can obtain basic information on a number of topical areas within a particular section. Those who have a better understanding of an area can find more detailed information on specialized topics (e.g., the chapters that are devoted to the specialized industries). One drawback is that a list of reference materials is not included at the end of each chapter or part. A person who is planning on investing in the U.S. might find a list of more technical reference materials helpful in his quest for knowledge about a particular topic.

The editors have done a good job of bringing together a wide variety of topics within a single volume. The chapters generally are well-written and possess about the same level of difficulty. The book should be interesting and informative to non-U.S. readers, but most U.S. readers probably will find it of limited value except as a means to obtain a basic understanding of a topic with which they have little familiarity.

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MARK W. DIRSMITH and ABRAHAM J. SIMON, *Local Government Internal Controls: A Guide for Public Officials* (New York: Council on Municipal Performance, 1983, pp. vii, 178, $19.95 paper).

Internal control should be a major concern of officials in the executive branch of a municipal government. A sound system of controls can help senior officials to better manage resources provided by taxpayers and creditors and to prepare reliable financial statements and operating reports. The underlying assumption of this book, however, is that many senior city officials of the executive branch do not have a complete understanding of an effective system of internal controls, their importance, and the problems associated with their implementation. This contributes to the existence of deficient systems of internal controls in municipalities. The authors assert that the reason for these perceptual problems is that senior officials too often do not exercise the degree of involvement with internal controls that is required to fulfill their ultimate responsibility. They have attempted to delegate this responsibility to staff or line managers. The book attempts to overcome these perceptual problems.

The purpose of the book is educational. It is intended to make high-level city officials aware of their primary responsibility for the design, implementation, operation, and maintenance of a sound system of internal control. It accomplishes this purpose by analyzing and discussing 1) the senior official's ultimate responsibility for internal control; 2) the general concept, objectives, and acceptable standards of internal control and how they relate specifically to city government; and 3) the importance of subjecting the control system to an annual independent evaluation and reporting internally and externally on its current status.

The main audience for the book apparently is intended to be high-level city officials (mayors, city managers, and audit committees). The subject matter is covered concisely and thoroughly. The book relies heavily on existing authoritative literature on internal control, principally from the U.S. General Accounting Office, the U.S. Office of Management and Budget, and the AICPA. It does a good job of synthesizing this literature and applying it to municipal governments. Sufficient supplementary material, such as checklists for senior city officials, is provided.

The book has limited academic usefulness as a supplement to a governmental accounting or auditing course. Interested academics, however, may find it useful as a personal and a library reference.

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MICHAEL N. FITZGERALD, *Tax Shelter Alternatives: Measuring the Risks* (Homewood: Dow Jones-Irwin, 1985, pp. x, 208, $35.00).

This book gives tax shelter investors a specific method for analyzing real estate, oil and gas, and equipment leasing shelters. It also includes discussion of rates of return and optimization of tax shelter portfolio investments.

The method uses a series of questions for each type of tax shelter. Each question requires the user to choose one of a finite number of possible responses. Each question and each response has been assigned a subjective value or weight by the author so that a particular tax shelter may be scored by summing the products of the question weight and response value.

The questions asked are clearly appropriate to the tax shelter being analyzed. Most can be answered from information in the prospectus, but some information (e.g., the track record of the syndicator) cannot. The questionnaire can be used for private or public offerings. It also can be a guide to investors on the relative risk of the offerings analyzed.

Questionnaires can be designed to ask all material, relevant questions if sufficient constraints are placed on the object of those questions. Each piece of real property, oil and gas property, and equipment is unique. In the analysis of any element of investment in unique properties, all methods are limited by the characteristics of a particular property. All relevant questions may not be included in the questionnaire. As with any method, the user must determine its appropriateness for the decision.

Development of an adequate method of evaluating risk in a tax shelter is a very complex task. The author clearly has taken a significant step in the right direction. A user can add questions to questionnaires and modify the weights assigned to any question. By doing so the model can accommodate relevant information not considered by the author's questionnaire.

The book has three potential user groups: investors, investment advisors, and students and instructors of property investment or taxation of investment classes. It would be appropriate for classroom use as a required supplemental reading.

Tax shelter investment decisions often are based on emotions, at least partially because the decision maker is unable to assess the investment adequately at any other level. At a minimum, the author's work can serve as a guide to the types of questions that should be asked and perhaps to the relative importance of each question. Use of the questionnaire by the investment advisor possibly could be helpful in fighting litigation from clients who have invested and lost in that the results of the questionnaire could give objective evidence that the client was warned of the degree of risk that accompanied the investment.

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HOWARD GODFREY, *Handbook on Tax-Exempt Organizations* (Englewood Cliffs: Prentice-Hall, Inc., 1983, pp. xxvi, 423, $39.95).

This book presents extensive guidance for those who work with or for U.S. nonprofit organizations. The first part explains the statutory, administrative, and judicial requirements for exemption, and the last part contains information on filing returns and dealing with the I.R.S. in areas such as auditing and appeals.

Although the book excludes one type and gives only minimum coverage of four types of exempt organizations, the author claims to provide detailed guidance for the types that are most prevalent and that constitute most of the nearly one million organizations recognized as exempt by the I.R.S. (p. vi).

This handbook would be a useful library reference for academic and practicing accountants who need quick answers to important questions on most aspects of tax-exempt organizations.

H.S.H.

JAMES R. GRIESEMER, *Accountants' and Administrators' Guide: Budgeting for Results in Government* (New York: John Wiley & Sons, 1983, pp. xii, 208, $55.00).

This book attempts to provide guidance to accountants and administrators interested in implementing results-based budgeting systems in local governmental units. The guide emphasizes a number of elements of the budgetary process which deserve mention and frequently are ignored in similar guides. But no reference is made to the substantial body of literature on PPB, ZBB, or MBO accumulated during the last 20 years that indicates the implementation process is much more problematic than the guide would suggest.

Although the guide has 208 pages, only 99 are substantive text. The remaining 109 pages are either chapter titles and end-of-chapter blanks (31) or appendices and the index (78 pages). Thus, each of the 19 chapters is extremely short and only highlights key concepts and ideas the author wishes to introduce.

The guide identifies three major elements of results budgeting that frequently are not addressed in other books. First, program goals are made operational through program performance measures, which are "consumer-" or "citizen-" oriented assessments of effectiveness gathered through attitude or user surveys. Desired program performance then is expressed as a percentage of citizens who are satisfied with the program goal. This orientation represents a major strength. Unfortunately, the guide does not indicate how the surveys are conducted and integrated into an ongoing budgetary process.

Second, employee performance standards are considered to be an indispensable part of results budgeting. After establishing goals, program performance measures, and annual objectives, attention shifts to the first-line operating employees and supervisors who physically generate the results achieved. Emphasis is placed on establishing standards of performance, a sense of personal responsibility for achieving objectives, and an appropriate reward structure to recognize individual contributions. It is refreshing to see an approach to budgeting that emphasizes the importance of line employee commitment to goal achievement, even though only four pages are devoted to the topic.

Third, the program structure is required to be compatible with the organizational structure. Elaborate crosswalks between programs and organizational units are to be avoided because of the difficulty of assigning responsibility to achieve results. The author believes that maintaining unity of command and principles of authority and responsibility outweigh elaborate program structures which cross organizational boundaries.

The guide is enjoyable and easy to read. Chapters are short, and there are numerous illustrations. The guide's major problem is that it does not address implementation problems. This is a significant omission for the accountant and administrator who must function in an inherently political environment.

Given this omission, the guide probably would not be appropriate for an experienced budgeting professional who is familiar with other technical discussions of budgeting. It is more appropriate for governmental officials who are introducing a management system for the first time or for participants in an executive management program interested in learning budgeting fundamentals. In either case the guide would have to be supplemented with recommendations and advice from professionals, such as the author, who have successfully implemented a results budgeting system.

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ANDREW A. HARIED, LEROY F. IMDIEKE, and RALPH E. SMITH, *Advanced Accounting*, Third Edition (New York: John Wiley & Sons, 1985, pp. xxiv, 981, $35.95).

The subjects covered in this edition are the same as those in the second edition (reviewed January 1983, pp. 193–194), with major chapter changes in three areas: partnership accounting is two chapters rather than three; foreign exchange accounting is increased to two chapters (Chapter 13 covers transactions while Chapter 14 is translation of foreign currency financial statements); and governmental and not-for-profit accounting is now three chapters with the addition of a chapter on nongovernment, nonbusiness organizations. Most of these changes seem to be part of a trend in recent advanced accounting books. For those schools emphasizing consolidations, Chapter 14 on translations could now be added to that emphasis since the complete thrust of the chapter is on parent/foreign subsidiary relationships.

The first 11 chapters on business combinations and consolidations comprise 48 percent of the book and are basically unchanged from the second edition. In both editions, the authors make extensive use of an appendix to illustrate the cost and modified equity methods. This is done in seven chapters, and it tends to confuse students and to detract from the main points introduced in each chapter. Pointing out the differences once, such as in Chapter 4 where it is first introduced, seems sufficient to inform students that alternatives exist and that adjustments in consolidation procedures might be necessary.

One of the weaker chapters in the book is Chapter 22 on estates and trusts. The authors devote only two pages to trusts (no problems are given) and fail to mention the "Uniform (or Revised) Principal and Income Act," even though accountants do more work with trusts than estates and often face principal and income decisions.

The mix of questions, exercises, and problems is reasonably good, but some of the problems are closer in length and complexity to an exercise. Other problems are merely regurgitations of chapter material and are not thought-provoking for students. In the consolidation chapters, most of the problems emphasize only current chapter material with very few that are comprehensive and build upon prior material. As a result, students are likely to have a difficult time handling situations involving more than one adjustment, such as purchase differentials along with inventory and fixed asset adjustments.

Computer disks (templates) that can be copied to student-supplied disks are available to adopters. The templates contain the formats of 55 of the 122 problems in Chapters 3 through 11 and 14 (all consolidation workpapers). Students who have access to computers are likely to have some reduction in set-up time for the workpapers but are less likely to see the relationships among accounts that would be experienced when using a manual system. In addition to the computer templates and other usual teaching aids, the publisher also provides transparencies for all or part of 48 problems (22 percent of all problems).

Overall, the book is slightly above average, since little was found that would truly distinguish it from other advanced accounting books. For most traditional advanced accounting courses the book should be considered, since it would adequately meet the needs of both teacher and student.

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JOHN A. HASLEM, *Bank Funds Management: Text and Readings* (Reston: Reston Publishing Co., Inc., 1984, pp. viii, 664, $28.95).

This book consists of 20 percent text materials and 80 percent readings. The organization of the book based on page count is: (1) about 35 percent on management of liquidity and security investments, (2) 40 percent on how assets and liabilities should be jointly managed to balance risk and return, and (3) 25 percent on introductory materials. The articles selected are from such professional journals as *The Bankers Magazine*, *Magazine of Bank Administration*, *Journal of Bank Research*, and reviews published by various regional Federal Reserve Banks.

The articles selected have a difficulty level that ranges from simple to moderately complex. In most articles, no effort is made to defend the method proposed by the author.

Although the book is titled *Bank Funds Management*, which is frequently regarded as the broadest concept of financial management applicable to *all* funds in a bank, the book does not discuss management of such traditional assets as consumer loans, commercial loans, and such modern assets as brokerage services or foreign exchange services. Nor does the book deal with strategies that can be used by banks to manage liabilities, including such questions as how to attract consumer deposits, when Eurodollars should be used to finance assets, and how and when long-term deposits should be attracted. The Financial Regulation Simplification Act of 1980 has altered significantly the way banks conduct their business. It is very regrettable that a book claiming to deal with the total fund management does not also contain articles dealing with these *new* important issues.

Finally, the section on assets and liabilities management contains several interesting observations on various management traps. But a conceptual paper discussing the difference between the duration and the gap approach in the management of maturities of liabilities and assets can enlighten the reader on the advantages and disadvantages of both approaches. Indeed, without such deliberations, readers may be left with the erroneous belief that they now have all the answers—an impression a book edited by an academic member can seek to avoid.

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JON D. JACOBS, Editor, *International Tax Summaries 1985: A Guide for Planning and Decisions* (New York: John Wiley & Sons, Inc., 1985, pp. ix, 1,013, $65.00).

This book is produced by the Coopers & Lybrand International Tax Network, and contains summaries of the tax systems of 99 different countries around the world. It is updated annually by tax professionals in each of the countries, and includes information on the tax structures of all the major trading partners of the United States. It is a reference work and is organized as such, with information on each country forming a separate chapter. Insofar as possible, the information for each country is presented in a standardized format, thus facilitating access and comparison. For two-thirds of the countries examined, the authors also have provided a very short discussion of various items on the form of business entity which should be considered by a nonresident who is contemplating investment in that country.

The book is clearly worded and makes liberal use of topic headings. Thus, although the information is in summary form, it does provide a quick, easy to read, yet accurate reference to a particular country's taxing structure. This makes the book an excellent reference work for practitioners and corporate executives. It is also a valuable resource for professors who are teaching graduate tax or MBA classes dealing with international transactions.

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ROBERT K. MAUTZ, PETER TIESSEN, and ROBERT H. COLSON, *Internal Auditing: Directions and Opportunities* (Altamonte Springs: The Institute of Internal Auditors Research Foundation, 1984, pp. xviii, 271, $47.00).

This book reports on an extensive questionnaire survey and study of internal auditing. The authors' principal objectives are: "to increase knowledge about internal auditing, to identify future educational needs for internal auditors, and to develop recommendations on directions for The Institute of Internal Auditors and other professional development efforts" (p. v).

Although the authors claim their survey design is neither valid nor intended for research on the state-of-the-art of internal auditing, the questions asked do have that tone and the report indicates a wide variety of practices in the surveyed corporations (volunteers from within the IIA's membership). This aspect of the report seems most valuable to auditing education at the university level. Also useful is the report on what has appeared on the conceptual aspects of internal auditing in texts and other literature defining the field.

The report does not seem appropriate for continuing education because it is descriptive of the status of internal auditing (e.g., the career interests of auditors) rather than instructive as to how to perform or manage internal auditing. For professional reading, especially by those considering entry into the field, the report offers some sobering information. For example, the salaries and promotion opportunities for internal auditors often are perceived as low and as major reasons to leave the field.

In summary, this book is not a text and not a tool for teaching the conceptual foundations of the field. Rather it is a report on survey results, anecdotal information gained from interviews, authors' suggestions and conjectures about the meaning of the data, and indications of areas for future research about the field of internal auditing. It deals heavily with internal auditing's struggle for identity. The report is descriptive of the current state of internal auditing, at least in the segment surveyed.

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PAUL S. NADLER and RICHARD B. MILLER, *The Banking Jungle: How To Survive and Prosper in a Business Turned Topsy Turvy* (New York: John Wiley & Sons, 1985, pp. xv, 447, $24.95).

This book presents a comprehensive review of the evolution of the depository industry, with particular attention to the past half-century, and the condition of the industry in the mid-1980s. It provides the reader with a concise historical document from which current banking activities can be understood. The book also contains suggestions for structuring a banking corporation so as to take into account the dramatic reduction in bank regulation anticipated in the near future.

Although the book is purportedly written for "America's bankers," far fewer than all of this class would find the book informative. The historical material it contains would be familiar to any careful reader of major business periodicals during the past several years. Indeed, some of the material presented appeared earlier in *Bankers Monthly, The Bankers Magazine,* and the *American Banker.* As a "survival guide" the book appears to provide few new ideas for experienced bankers. Much of the book is devoted to describing the rudiments of the business of banking and the environment in which banks operate.

The book is of most value to the novice, who will find it an excellent review of banking practiced by successful bankers during the past decade. It also is unique in that it is a compendium of the practical financial, regulatory, and personnel issues which a bank is likely to face.

The book would be of particular value to the recent graduate joining a banking institution. It would facilitate his or her orientation in an industry that, due to its rapid change, is at best misunderstood but more frequently unjustifiedly criticized by those unaware of current business practices.

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DAVID L. SCOTT and GEORGE FIEBELKORN, *Dictionary of Accounting* (Totowa, NJ: Rowman & Allanheld, Publishers, 1985, pp. v, 144, $19.95 cloth, $7.95 paper).

This dictionary claims to be "a quick reference to nearly 2,000 accounting terms" (frontispiece), but this overstates by about 50 percent the 1,306 terms discovered in an actual count.

This volume has about 250 fewer terms, less complete definitions in the sample compared, and about the same price as Davidson, Stickney, and Weil's *Accounting: The Language of Business* (Sixth Edition, 1984). It has one major advantage (aside, possibly, from some minor differences in terms selected): the paperback version is small enough to be considered a "pocket book."

In summary, this book seems to have at most a small niche. It would be useful to anyone wanting a compact, readily available reference to a limited number of accounting terms.

H.S.H.

DAN THROOP SMITH and BERTRAND FOX, *An Analysis of Value Added Taxation in the Context of the Tax Restructuring Act of 1980* (Morristown: Financial Executives Research Foundation, 1981, pp. xx, 155, $4.00 paper).

STEPHEN M. BRECHER, DONALD W. MOORE, MICHAEL M. HOYLE, and PETER G. B.

TRASKER, *The Economic Impact of the Introduction of VAT* (Morristown: Financial Executives Research Foundation, 1982, pp. vi, 125, $4.00 paper).

These two studies were commissioned by the FERF shortly after the then chairman of the Committee on Ways and Means, Al Ullman, introduced a proposal in 1979 that would have imposed a ten percent value-added tax (VAT) on most U.S. goods and services. The Smith and Fox study is an extensive econometric study of the potential effects of a VAT on consumption, income, investment, production, and inflation. The quantitative analysis relies primarily on simulations made using a comprehensive macro-economic model developed by Data Resources, Inc. The five tax-offset components contemplated in the Ullman proposal (liberalized capital recovery, reductions in personal income taxes and employee payroll taxes, reduction of corporate income taxes, and postponement of employer-paid payroll taxes) are separately analyzed. The authors conclude that the tax offset that best achieves Ullman's goal of stimulating investment, productivity, and consumption is the liberalizing of capital recovery (this later became a key element in the Economic Recovery Tax Act of 1981). In general, the authors conclude from their simulations that over time, the net effect of a VAT would be to significantly increase real business fixed investment without significantly dampening consumption.

The Brecher, et al. study analyzes the VAT experiences of five European countries (France, Germany, Italy, Sweden, and the UK) at the time the VAT was introduced and over time. The authors conclude that the effects of the introduction of a VAT on prices and wages are a function not of anything inherent in the tax itself, but rather stem from which taxes the VAT replaces, the transition rules chosen, the socio-political background, the rate structure of the VAT, and even the levels of sophistication of the power groups in a society (e.g., labor unions).

Although calls for a VAT in the U.S. currently are muted (the Treasury rejected the VAT as an alternative source of revenue in its recent tax reform proposals), these two studies provide a comprehensive analysis of the components and possible consequences of a VAT system.

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EARL A. SPILLER, JR. and MARTIN L. GOSMAN, *Financial Accounting: Basic Concepts*, Fourth Edition (Homewood: Richard D. Irwin, Inc., 1984, pp. xx, 802, $28.50).

In preparing the fourth edition of this textbook, Spiller and Gosman have retained the objective of providing a management-oriented approach to financial accounting (the third edition was reviewed April 1979, pp. 477–478). It is one of the few nontraditional financial accounting texts that attempts to blend conceptual and procedural aspects without getting bogged down in details. It is most suitable for the MBA curriculum or executive development courses where the emphasis is on training people to use accounting information rather than to be accountants. The text covers the entire gamut of financial accounting from the beginning fundamentals (e.g., the accounting cycle) through advanced topics (e.g., business combinations).

Several improvements have been made in this edition. Included is a copy of the 1981 annual report from Armco, Inc. This report is discussed with each topic from a user, interpretative orientation, and is well integrated into the text. Early in the book, definitions, discussions, and concepts from the FASB's conceptual framework are introduced. A glossary of terms has been added, something that always is a big help to students. The subject matter has been updated, and the authors provide discussion of where students can expect to see changes (e.g., pension accounting).

A few weaknesses should be noted. The treatment of leases tends to be terse and technical. Insufficient coverage is given to supplementary disclosures, accounting changes, earnings per share, the cash basis for the statement of changes in financial position, and alternatives to ratio analysis for financial statement analysis. Discussions regarding inflation accounting, pensions, and income taxes are wordy and redundant. And the problem material generally consists of fairly straightforward examples of the text discussion, rather than in-depth or inquisitive analysis. Thus a case book or actual annual reports may be necessary for an MBA or executive level course.

In the Preface, the authors state their objective as follows: "The primary aim is to develop the readers' ability to understand, interpret, and analyze the financial statements of business organizations" (p. vii). That objective has been accomplished.

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DONALD H. TAYLOR and G. WILLIAM GLEZEN, *Auditing: Integrated Concepts and Procedures*, Third Edition (New York: John

Wiley & Sons, 1985, pp. xxviii, 905, $33.95).

The third edition of this auditing text continues to emphasize both concepts and procedures and in many respects is very similar to the previous editions (the second was reviewed October 1982, pp. 857–858). While the same basic approach has been retained, this most recent edition contains many updates and revisions.

One of the noteworthy revisions can be found in the topical areas of audit risk, materiality, and sampling. The text currently includes a separate chapter that effectively integrates key theoretical concepts from Statements on Auditing Standards Nos. 39 and 47. This material serves as a foundation for two subsequent chapters. One chapter illustrates how the theoretical concepts can be applied to both statistical and nonstatistical sampling plans designed to test compliance with internal accounting control, while the second chapter consistently applies the same theoretical concepts to substantive tests of account balances.

Another significant modification is in the authors' presentation of the various aspects of auditing in an EDP environment. This edition contains an expanded and updated description of internal controls in an EDP environment, as well as an updated discussion describing the tools and techniques that can be used by auditors to accomplish their audit objectives in various types of EDP environments. The text also contains a brief, but informative, overview of SEACAS (The Systems Evaluation Approach-Computerized Audit Support) which is a new approach developed by Peat, Marwick, Mitchell & Co. to conduct substantive tests with microcomputers.

Another significant feature of this edition is that it has retained a separate chapter devoted to operational auditing. This should be of particular interest to those who are attempting to comply with American Assembly of Collegiate Schools of Business (AACSB) accreditation standards for baccalaureate programs with a concentration in accounting. The AACSB presently requires that undergraduate accounting curricula include both financial and operational auditing (AACSB, *Accreditation Council Policies Procedures And Standards—1983-84*, p. 42). While the 25-page chapter that is devoted to the subject gives an excellent general overview, most instructors will find that a considerable amount of supplementary material is needed to instill a basic understanding of this topic.

Overall, this third edition has been improved by the changes that have been made. The text continues to be suitable for either a one- or two-semester undergraduate auditing course. It is well organized, easy to understand, and adequately supplemented with a solutions manual containing transparency masters, a test bank, a student study guide, and a related case study.

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RICHARD A. WESTIN, *Lexicon of Tax Terminology* (New York: John Wiley & Sons, 1984, pp. ix, 845, $65.00).

"[T]he purpose of this book is to offer a usable dictionary of tax terminology, ranging from hypertechnical terms to slang usage, both to refresh the user's memory and to offer summaries of words, phrases, and authorities . . . that can be used as starting points for further exploration" [p. vii].

"[T]he definitions contain references to the Internal Revenue Code, Treasury and Labor Regulations, Revenue Rulings, Revenue Procedures, Private Letter Rulings, treatises, articles, and case law . . . Other materials cited were selected because [the author considered them to be] of direct importance" [p. vii].

"Users . . . are asked to understand that the definition or definitions following a heading may not cover all the various definitions of a particular term, because of the seemingly endless permutations of meaning planted throughout the Code and its judicial and administrative interpretations" [p. vii].

The lexicon achieves its purpose. Its coverage is quite complete and its definitions are extensive—some were almost a full page long. This work would be a welcome addition to the library of an accounting professional.

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ARTHUR J. WILBURN, *Practical Statistical Sampling for Auditors* (New York: Marcel Dekker, Inc., 1984, pp. x, 410, $39.75 U.S. and Canada, $47.70 elsewhere).

This book was designed to provide "a working knowledge of practical sampling procedures for use in auditing and related activities" (p. iv). Although some passages are confusing, it generally is quite readable. Various practical examples illustrate the use of different sampling methods. The interplay between statistical sampling and professional judgment (experience) is emphasized. Professional judgment and experience are essential in the choice of appropriate statistical sampling methods for specific audit situations.

This book would be more appropriate as supplementary reading than as a textbook for an audit sampling course. It has no exercises that could be assigned for practice, and some of the different methods introduced are not illustrated by worked numerical examples. Suggestions for modifications of sampling methods to suit certain situations sometimes are given, but the corresponding formulas are not. Some formulas for relatively simple sample designs are given, but for formulas for more complicated designs, the reader often is referred to survey sampling books, usually without a quoted chapter or page. Two statistical approaches (frequentist and Bayesian) are mentioned as useful in auditing, but the book focuses only on the frequentist (classical) approach and its related statistical methods.

The major shortcoming of the book is its inaccurate statistical statements, definitions, and interpretations. For example, the conditional probability of A given B, $P(A|B)$, often is interpreted as $P(B|A)$. More specifically, Appendices C and D provide hypergeometric probabilities of finding x errors in a sample of n, given the universe size, the sample size, and the true number of errors (or the error rate) in the universe (p. 171). These probabilities are interpreted as probabilities of error rates of the universe given the observed sample (pp. 138–139 and elsewhere). The incorrect definition of consistency (p. 261) implies that any unbiased estimate is consistent. The standard deviation of a sampling distribution is said to be "the standard deviation of the universe divided by the square root of the sample size" (p. 237). This is true only for the sampling distribution of the sample mean (*not* the sample sum or the sample median, for example).

The author states that a limitation of dollar-unit sampling is that the upper dollar error limit is conservative (p. 176). The limit is conservative if Stringer's bound is used, but not if more recently proposed error limits are used in conjunction with dollar-unit sampling. Other inaccurate statements appear throughout the book.

In summary, the author has provided many interesting examples of problems and appropriate sampling methods for auditing. But the inaccurate statistical statements and interpretations might mislead the general reader. Nevertheless, the book could be used as supplementary reading or for general background in applying statistical methods in auditing.

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SOFTWARE SUMMARIES

Harvey S. Hendrickson, Editor

ANGELO E. DIANTONIO, *Spreadsheet Applications in Managerial Accounting* (Reston: Reston Publishing Co., Inc., 1985, pp. xv, 319, $18.95).

This book provides generic spreadsheet templates for most applications encountered in introductory managerial accounting. Each chapter begins with a list of problems and a brief outline of the topics covered. The problems are identical in format. Each takes up a single page and includes a section called "screen display" which shows the given data and the solution. A "cell content" section includes the headings, entries of raw data, and cell formulas necessary to obtain the solution. Each problem is accompanied by several sets of "given data" which the student can plug into the spreadsheet. This approach enables the student to "focus on the concepts in the problem without the tedium of arithmetical computations" (p. 94).

A major difficulty with this strategy is that the student can mindlessly enter the data and formulas, arrive at the correct solution, and not have the slightest notion *why* a given calculation is required. Assignments from this book could be made more productive if students were asked to develop extensions of the templates. For example, one template that computes the slope and intercept for a flexible budget equation using OLS regression could be expanded to compute the *r*-square value, fitted values, standard errors, and *t*-statistics.

This reviewer worked a number of the problems using Lotus 1-2-3, and in the process encountered several serious errors. The cell formulas for the regression template noted above do not give the correct regression coefficients. In presenting the cell content for a step-down allocation problem, the author did not expand the columns enough to print the entire cell formulas. Other formulas in the same problem were either incorrect or confusing. Several printed solutions contain arithmetic or typographical errors.

The electronic worksheet has been around since the introduction of Visicalc in 1979. But academic accountants have begun only recently to realize the potential for the use of spreadsheets in student assignments. While not without flaws, this book is a step toward the integration of the electronic worksheet into the teaching of managerial accounting.

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SAM A. HICKS and DONALD V. SAFTNER, *The Use of Microcomputers in Accounting* (St. Paul: West Publishing Co., 1985, pp. xx, 349, $12.95 paper, diskette free to adopters).

This book is a broad introduction to microcomputers and microcomputer software. The first three chapters cover hardware, software, and the general idea of a spreadsheet. The remaining chapters are application-oriented, covering spreadsheets (Lotus 1-2-3 and SuperCalc 3, three chapters each), database management (dBase II and III, three chapters), and word processing (Wordstar, one chapter).

The initial discussion of spreadsheets is designed for the first-time user; topics such as booting the system and using menus are reviewed. The other chapters on spreadsheets deal with the use of commands and such advanced topics as graphics, data commands, printer setup strings, and macros (for Lotus). The explanations of the commands are clear and supported by illustrations.

Each chapter has exercises to help the student develop skills in the use of major commands. Also included is a chapter of spreadsheet problems with applications in financial and managerial accounting. The problems have a wide range of complexity. Some use templates on the diskette; others require that a student develop a complex spreadsheet from scratch. The latter enable the student to use the power of the computer to solve more difficult problems, without eliminating the need for original thinking and a thorough understanding of the material.

The section on dBase II and III begins with a general treatment of the concept of a database and an introduction to the most essential dBase commands. Again, brief exercises are provided to help the student develop familiarity with the system.

Subsequent chapters cover more advanced commands and dBase programming.

The section on Wordstar is relatively brief and in the same format as the rest of the book.

This book is well organized, well written, and a good alternative source of information about five commonly-used programs. A detailed table of contents provides a partial substitute for the lack of an index. Although the book is designed for accounting undergraduates, any business student who anticipates more than occasional use of the software covered should find it to be a useful resource.

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GEORGE HILDEBRAND, *Using Microcomputers in Managerial Accounting* (Santa Cruz: Mitchell Publishing Inc., 1985, pp. xi, 267, $10.95 paper, diskette free to adopters).

This book is designed to provide students with hands-on experience in using microcomputers for managerial accounting applications, and can be used with a standard text. The instructor's guide comes with a diskette containing over 30 programs written in BASIC for the IBM PC and IBM compatibles. The programs cover a full range of managerial accounting topics.

Each of the 12 chapters in the book contains a brief topical review, followed by a detailed explanation of the various application programs, including sample problems and solutions. Each chapter concludes with a number of additional problems that are to be solved with the programs. These are in "workbook" format; students are asked to respond to various questions about the computer output. The workbook contains many "what if?" questions. Understanding the results is important.

Students who use this book will enjoy the speed of calculation and the ease with which similar problems can be worked without repetitive pencil pushing. But many of the programs lead the student through problems step-by-step, obviating the need for creative thinking. Thus the programs can easily become a substitute for the clear understanding of conceptual relationships needed to solve problems "by hand."

In addition to the problem-oriented programs, the diskette contains two computer-assisted instruction (CAI) programs. These consist of a series of true-false questions covering basic managerial accounting concepts. The book could be strengthened by incorporating the CAI approach into problem solving.

Users of this book should find that it enables students to gain hands-on experience with microcomputers. Given the format of the book and associated programs, it also should be helpful in increasing the understanding of the output of accounting reports, rather than the mechanics of analyzing accounting data.

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BOOKS RECEIVED APRIL 21, 1985 TO JULY 20, 1985

AVNER ARBEL, *How to Beat the Market with High-Performance Generic Stocks: Your Broker Won't Tell You About* (New York: William Morrow and Co., Inc., 1985, pp. iv, 223, $16.95).

JEAN-LOUP ARDOIN, DANIEL MICHEL, and JEAN SCHMIDT, *Le Controle de Gestion* (Paris: Publi-Union, 1985, pp. 448, FF 340,000 paper).

JEFFREY S. ARPAN and LEE H. RADEBAUGH, *International Accounting and Multinational Enterprises,* Second Edition (New York: John Wiley & Sons, 1985, pp. xiii, 370, $32.95).

BEN B. BARR, ROBERT L. GRINAKER, and WILLIAM J. MORRIS, JR., *Short Audit Case: The Valley Publishing Company,* Fifth Edition (Homewood: Richard D. Irwin, Inc., 1985, pp. iv, 203, $18.95 looseleaf).

M. EDGAR BARRETT and WILLIAM J. BRUNS, JR., Editors, *Case Problems in Management Accounting,* Second Edition (Homewood: Richard D. Irwin, Inc., 1985, pp. xii, 480, $28.50).

A. D. BARTON, *The Anatomy of Accounting,* Third Edition (St. Lucia, Aus. and New York: University of Queensland Press, 1984, pp. xv, 775, Aus. $35.00, $30.00).

AHMED BELKAOUI, *International Accounting: Issues and Solutions* (Westport, CT: Quorum Books, 1985, pp. xiv, 364, $39.95).

LESTER ROBERT BITTEL and JACKSON EUGENE

Ramsey, Editors, *Handbook for Professional Managers* (New York: McGraw-Hill Book Co., 1985, pp. xxxix, 1000, $59.95).

James Botkin, Dan Dimancescu, and Ray Stata, *The Innovators: Rediscovering America's Creative Energy* (New York: Harper & Row, Publishers, 1984, pp. vii, 312, $16.95).

Philip Brown, George Foster, and Eric Noreen, *Security Analyst Multi-Year Earnings Forecasts and the Capital Market,* Studies in Accounting Research No. 21 (Sarasota: American Accounting Association, 1985, pp. ix, 171, $12.00 paper).

D. R. Carmichael and Martin Benis, *Wiley-Ronald Auditing Service 1985* (New York: John Wiley & Sons, 1985, pp. viii, 633, $90.00 looseleaf).

John Mack Carter and Joan Feeney, *Starting at the Top: America's New Achievers—Twenty-three Success Stories Told by Men and Women Whose Dreams of Being Boss Came True* (New York: William Morrow and Co., Inc., 1985, pp. 252, $15.95).

Louis J. Celi and I. James Czechowicz, *Export Financing: A Handbook of Sources and Techniques* (Morristown, NJ: Financial Executives Research Foundation, 1985, pp. xix, 439, $16.00 paper).

Shitangshu K. Chakraborty and Bipul K. Bhaumik, *Management and Accounting for Research and Development—The Indian Praxis* (Calcutta: The Institute of Cost and Works Accountants of India, 1984, pp. xi, 344, Rs. 100.00, $25.00).

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Accounting and Business Research

A research quarterly published by the Institute of Chartered Accountants in England and Wales

Editor: R. H. Parker, University of Exeter

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A Research Annual

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JANUARY 1986 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 33583. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $100 per insertion. Ads should not exceed 100 words.*

#101 CALIFORNIA STATE UNIVERSITY, STANISLAUS seeks faculty in Accounting. Rank and salary open, depending on qualifications. Undergraduate and graduate programs. Teaching excellence is stressed; scholarship and professional activity encouraged. Require relevant doctorate earned or very close to completion. Prefer proven record of teaching excellence. Strength in Auditing especially desired. CPA preferred. Modern facilities, rural setting, low-cost housing. 4-1-4 calendar eliminates disadvantages of traditional semester and quarter systems. Two-hour drive to San Francisco or High Sierra. Cal State Stanislaus is an Affirmative Action/Equal Opportunity/Title IX/Section 504 employer. Applications and inquiries should be directed to: Dr. Robert Van Regenmorter, Chair; Accounting Faculty Search Committee; Department of Accounting; School of Business Administration; California State University, Stanislaus; Turlock, CA 95380; Telephone (209) 667-3671.

#102 WEST VIRGINIA UNIVERSITY invites applications for a permanent or visiting accounting faculty position at the Assistant or Associate Professor level. Preference will be given to candidates in the Accounting Information Systems and Micro Computer area. Candidates should be profession and research oriented, as well as committed to quality teaching at the undergraduate and Masters of Professional Accountancy (MPA) level. A Ph.D./DBA or doctoral dissertation stage is required. A nine-hour, two-preparation load is normal. The College of Business and Economics is AACSB-accredited. Send resumé to Dr. Gail Allan Shaw, Chairman, Department of Accounting, College of Business and Economics, West Virginia University, P.O. Box 6025, Morgantown, WV 26506. WVU is an Affirmative Action, Equal Opportunity Employer.

#103 WOFFORD COLLEGE is seeking applications for tenure-track position in accounting at the assistant professor level for September 1986. Candidates should have an MA degree with CPA or CMA and a strong commitment to excellent teaching. Courses to be taught include principles, intermediate, and cost accounting. Wofford is an equal opportunity employer and invites applications from women and minorities. Please send resumé and letters of recommendation to Matthew A. Stephenson, Chairman, Department of Economics and Accounting, Wofford College, Spartanburg, South Carolina 29302.

#104 POSITION WANTED: DBA in Accountancy; MBA; CPA; eight years of teaching experience and several years of public accounting and consulting. Seeking position with college or university which stresses and supports quality teaching and research. Teaching areas: Auditing and Financial Accounting. Available: Summer/Fall 1986.

#105 SUFFOLK UNIVERSITY, Boston, Massachusetts. The School of Management's Accounting Department anticipates tenure-track openings at the assistant/associate professor levels to teach undergraduate/graduate courses in managerial and/or financial accounting. Ph.D. or DBA required. ABDs in final stage considered. Evidence of teaching and research competence required. Professional certifications desirable. Apply to: Ronald Sundberg, Associate Dean, School of Management, Suffolk University, 8 Ashburton Place, Beacon Hill, Boston, MA 02108 or call (617) 723-4700, ext. 307. An equal opportunity, affirmative action employer.

#106 INDIANA STATE UNIVERSITY is seeking faculty members in Accounting for tenure-track positions beginning August 1986. Teaching interests may be Financial, Auditing, or Tax area. Earned doctorate with CPA or CMA certification is preferred; ABDs will be considered. Salary and rank will be commensurate with qualifications and experience. All interested parties are encouraged to apply. Send resumé to Dr. Henry Longfield, Chairman, Department of Accounting, Indiana State University, Terre Haute, Indiana 47809. Indiana State University is an equal opportunity, affirmative action employer.

#107 THE A. B. FREEMAN SCHOOL OF BUSINESS at Tulane University is seeking a senior associate or full professor of accounting with a proven research record. This individual will have the opportunity to participate in and provide guidance for the School's drive for national prominence in research and teaching at the undergraduate, M.B.A., and Ph.D. levels. Salary and research support will be competitive at the highest levels. Send resumé to John Page, A. B. Freeman School of Business, Tulane University, New Orleans, LA 70118. Tulane University is an equal opportunity, affirmative action employer.

#108 ASSOCIATE OR FULL PROFESSOR OF ACCOUNTING. Two positions available. Ph.D. or DBA in Accounting required; CPA, CIA or CMA preferred. Established research record required. Salary, open and competitive. Positions available August 1986. Send resumé, transcripts and references to: Dr. Tim Miller, Chairman, Department of Accounting, Murray State University, Murray, KY 42071. Equal Opportunity/Affirmative Action Employer.

#109 ACCOUNTING. One opening anticipated in Accounting beginning July 1, 1986. Qualifications include a notable academic record, demonstrated ability in teaching and research scholarship as well as the ability and interest to work at the interface of accounting and economics. Normally, completion of the Ph.D. is required at the time of appointment. Assistant Professor preferred, but tenured appointment possible for unusually qualified candidate. Salary and rank dependent on qualifications. Candidates should submit a resumé, and published and prepublished work and evidence of teaching performance. They should also arrange to have at least three letters of recommendation sent to Professor William S. Comanor, Chairman, Department of Economics, University of California, Santa Barbara, California 93106. Applications will be accepted until February 15, 1986. The University of California is an Equal Opportunity/Affirmative Action Employer.

#110 PROFESSOR OR ASSOCIATE PROFESSOR OF ACCOUNTING, California State University, Fresno (midway between San Francisco and Los Angeles, in the San Joaquin Valley). Applications for 1986–87 are being accepted from candidates who can demonstrate teaching effectiveness, research capabilities, and an interest in teaching graduate and undergraduate courses. The doctorate, or equivalent, is normally required for a tenure-track appointment. Applicants having the doctorate and CPA, CMA, or CIA certification, with professional business and teaching experience, are preferred. Graduate and undergraduate programs are accredited by AACSB. California State University, Fresno, is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their vitae to Elwyn L. Christensen, Department of Accountancy, California State University, Fresno, CA 93740-0008.

#111 GEORGETOWN UNIVERSITY, Washington, D.C. The School of Business Administration invites applications for tenure-track positions in accounting for Fall 1986. Depending on experience and qualifications, appointment at the assistant or associate level is possible. Candidates should have a strong commitment to excellence in teaching and research. Salary and fringe benefits are fully competitive with top tier schools. Georgetown University is an equal opportunity/affirmative action employer. Please send resumé and references to: Elizabeth W. Barton, Director of Administration, School of Business Administration, Georgetown University, Washington, D.C. 20057.

#112 CENTRAL MICHIGAN UNIVERSITY has one or more faculty openings for the 1986–87 academic year. While all areas are encouraged to apply, the primary needs are in financial accounting and taxation. Ph.D. or near completion is required, professional certification is desirable. JD/MS (tax)/CPA or LLM/CPA may be considered for taxation positions. Rank is open depending on qualifications. Competitive salary with excellent benefits. Maximum of nine-hour load per semester; summer teaching and research opportunities available. Excellent working and living environment. Undergraduate business programs are AACSB accredited. Contact: Edward B. Grant, Chairman, Department of Accounting, Central Michigan University, Mt. Pleasant, MI 48859. CMU is an AA/EO institution; all parties are invited to apply.

#113 CANISIUS COLLEGE, Buffalo, New York, has openings for positions in financial and managerial accounting starting in the Fall of 1986. Applicants should possess a Ph.D. or D.B.A. with a concentration in accounting. ABDs and CPAs (or CMAs) at the advanced stage of their dissertation will be considered. Canisius College is a Jesuit institution with over 4,500 students. The graduate and undergraduate business programs are fully accredited by the AACSB. The Department of Accounting enjoys a very close relationship with the accounting community and is introducing a concentration in professional accounting at the MBA level. Applications should be addressed to Dr. Robert R. Davis, Chairman, Department of Accounting, Canisius College, Buffalo, New York 14208. AA/EOE.

#114 SAN DIEGO STATE UNIVERSITY has two tenure-track openings for Assistant, Associate, and Full Professors in the areas of accounting systems and financial accounting, to begin Fall 1986. If necessary, one-year or multi-year temporary employment may be available. The University is an Equal Opportunity/Affirmative Action Employer. Please contact G. E. Whittenburg, Director, School of Accountancy, San Diego State University, San Diego, CA 92182. Telephone (619) 265-5310. A doctorate (or ABD) granted by a university with an AACSB-accredited graduate program is required. CPA/CMA highly desirable.

#115 POSITION WANTED: MBA, CPA, sixteen years full-time teaching; also experience in both industry and public accounting. Prefer Midwest or Rocky Mountain areas.

#116 THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO is seeking applications for faculty positions in Accounting (rank is dependent upon qualifications). Doctorate is desirable, however, doctoral candidates at advanced dissertation stage will be seriously considered. Research is expected. Salary negotiable. Send resumé to Dr. Phyllis A. Webster, Department of Accounting, School of Business and Economics, The University of North Carolina at Greensboro, Greensboro, NC 27412. Call (919) 379-5647. An Equal Opportunity, Affirmative Action Employer.

#117 UNIVERSITY OF BALTIMORE invites applications for tenure-track positions in accounting. Teaching excellence is stressed; research experience and professional activities required. Applicant must possess the doctorate or equivalent (Ph.D., DBA, LLM/CPA). The University of Baltimore is an upper division, AACSB-accredited institution at the Junior, Senior, and Master levels (Masters of Taxation and Masters of Accounting). Forward your resumé to Dr. Charles L. Martin, Jr., CPA, Accounting Department, 1401 North Charles Street, Baltimore, Maryland 21201. The University of Baltimore is an Equal Opportunity, Affirmative Action Employer.

#118 DUKE UNIVERSITY—The Fuqua School of Business is seeking highly qualified faculty members in accounting. The qualifications required for these positions are a demonstrated interest in and capacity to do publishable research and a high level of competence in classes for MBAs and Ph.D.s. A Ph.D. degree is required. Rank and salary depend upon qualifications. Send resumé and list of references to Prof. David A. Dittman, Fuqua School of Business, Duke University, Durham, NC 27706. Duke University is an Affirmative Action, Equal Opportunity Employer.

#119 SOUTHWESTERN UNIVERSITY is seeking applications for an appointment at the Assistant or Associate Professor level of accounting. Applicants should hold the Ph.D. or DBA degree or be in the doctoral dissertation stage. Applicants should be qualified to teach a variety of undergraduate accounting courses. Southwestern is an undergraduate liberal arts institution related to the United Methodist Church. It is located on the outskirts of Austin, has an academically well prepared student body and a substantial endowment. Contact G. Benjamin Oliver, Dean, The Brown College of Arts and Sciences, Southwestern University, Georgetown, Texas 78626. An Equal Opportunity/Affirmative Action Employer.

#120 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August 1986, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold an appropriate doctoral degree; professional experience and/or certification are recommended. Applicants in final stages of doctoral study may be considered for tenure-track positions with the requirement that the degree be completed during a specified time period. For temporary appointments, the applicants must have a master's degree, professional experience and/or certification, and must show evidence to pursue the appropriate doctorate degree. Visiting appointments with doctoral degrees or with major preparation and professional accomplishments (one-year temporary employment) may be available as needed. Send application letter and resumé to Dr. Amin Elmallah, Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. Closing date for applications is July 31, 1986. CSU, Sacramento is an Equal Opportunity/Affirmative Action/ Handicapped/Title IX/Vietnam Era Veteran Employer.

#121 CLEVELAND STATE UNIVERSITY seeks candidates for faculty position in Accounting. Rank dependent upon qualifications. Candidates for Assistant Professor should have doctorate, or at least be in advanced dissertation stage. C.P.A., C.M.A., or C.I.A. and research capacity favorably considered. Candidates for Associate and Full Professor must have doctorate and record of publication. Salary negotiable. Send resumé to: Dr. Elise G. Jancura, Chairperson, Departments of Accounting and Business Law, Cleveland State University, 1983 E. 24th Street, Cleveland, Ohio 44115. (216) 687-4721. Equal opportunity employer m/f/h.

#122 IDAHO STATE UNIVERSITY has two tenure-track positions at the Assistant/Associate rank to teach accounting at the graduate and undergraduate levels. Ph.D. in Accounting is preferred, but advanced ABDs will be considered. Relevant professional accounting experience plus CPA and/or CMA preferred. Starting date is August 29, 1986. Send application, vitae, official transcripts and three current letters of recommendation to Dr. Kermit G. Cudd, Dean, College of Business, Idaho State University, Pocatello, ID 83209. Positions are open until filled. Salary is competitive. Idaho State University is an Affirmative Action/Equal Opportunity Employer and encourages applications from minorities and women.

#123 THE UNIVERSITY OF NORTHERN IOWA, School of Business, Department of Accounting, is seeking candidates for a permanent position in accounting at either the Assistant or Associate level. The candidate should be prepared to teach high-quality M.B.A. students and advanced courses to an unusually motivated group of undergraduates. The School of Business, which includes 58 full-time equivalent faculty members, provides an environment of warm collegial relationships coupled with a high degree of professionalism. Performance evaluation is based on a blend of good teaching, research, and professional service. The blend is tailor-made to fit each faculty member's needs and interests. The university is located in a prosperous metropolitan area of 130,000 with abundant opportunities for executive development and consulting. Salary will be competitive. The University of Northern Iowa is an affirmative action employer. Women and minorities are encouraged to apply. Send current vita to Dr. Gaylon Halverson, Head, Department of Accounting, School of Business, University of Northern Iowa, Cedar Falls, IA 50614.

#124 UNIVERSITY OF PITTSBURGH, Graduate School of Business. Applications are being sought for a faculty member at the assistant professor level to teach in the accounting area for Fall 1986. Candidates should have the Ph.D. or be near completion of the degree, and have a strong commitment to teaching and research. Salary is competitive. As an equal opportunity employer, the University of Pittsburgh is especially interested in making the position known to minorities and women. Interested candidates should send a letter of application and curriculum vitae to John C. Camillus, Associate Dean, 372 Mervis Hall, Graduate School of Business, University of Pittsburgh, Pittsburgh, PA 15260.

#125 FACULTY POSITIONS IN ACCOUNTING—California State University, Fullerton, is seeking six accounting faculty to teach in its undergraduate and master's programs. Specific needs include auditing, systems, financial/international, tax, and financial accounting. Tenure-track applicants should have an appropriate doctorate or ABD status and research potential. Lecturers require an appropriate doctorate or master's degree and CMA, CPA or CIA. Lecturer position may be renewable contingent upon satisfactory performance. Rank and salary commensurate with qualifications. Inquiries and resumé should be sent to Dr. Trini Melcher, Chair, Department of Accounting, School of Business Administration and Economics, California State University, Fullerton, CA 92634. Applications accepted until positions filled. An affirmative action, equal opportunity employer.

#126 THE UNIVERSITY OF MICHIGAN Graduate School of Business Administration has openings at all levels in their Accounting Department. Applicants for: *Assistant/Associate* should have earned doctorate with demonstrated skills in research and teaching. Applicants for *Associate/Full Professor* should have earned doctorate, recognized teaching and research record, leadership in scholarly program development. If interested, send vita and references to: Paul Danos, Chairman, Accounting Department, Graduate School of Business Administration, The University of Michigan, Ann Arbor, MI 48109-1234. The University of Michigan is a non-discriminatory, affirmative action employer.

#127 MANHATTAN COLLEGE—Tenure-track faculty positions. A Ph.D./DBA is required (CPA/CMA desired). Salary and benefits competitive. Manhattan College is a 135-year-old institution. The School of Business was founded in 1928 and has an enrollment of 1,011 undergraduates. There is an MBA program. The School is located ten miles north of midtown New York City in residential Riverdale. Resumés should be sent to: Dr. Walter O. Baggett, Chairman, Accounting Department, School of Business, Manhattan College, Manhattan College Parkway, Riverdale, NY 10471. An Affirmative Action/Equal Opportunity Employer.

#128 THE AMERICAN UNIVERSITY IN CAIRO announces two faculty vacancies beginning in September 1986, both for Assistant, Associate, or Full Professors. One to teach essentials of accounting, costing and managerial accounting, and accounting for operations management; the other to teach business finance, financial management, and managerial economics. Ph.D. required. Language of instruction is English. Two-year appointments (renewal possible) include air travel, housing, and schooling for expatriates in addition to salary. Write, with resumé, to: Dean of the Faculty, The American University in Cairo, 866 United Nations Plaza, New York, NY 10017.

#129 THE COLLEGE OF CHARLESTON is currently searching for an additional Accounting faculty member. The College of Charleston is located in the historic district of Charleston, South Carolina. It is near beautiful beaches and a thriving industrial and commercial center. It offers a congenial and stimulating teaching environment. Ph.D. or equivalent is required. A.B.D. in final stages of dissertation are encouraged to apply. CPA is also desired. Rank and salary depend upon qualifications. Send resumé and list of references to Dr. Mack Tennyson, Chair, Search Committee, Business Administration and Economics, College of Charleston, Charleston, SC 29424. The College of Charleston is an Affirmative Action/Equal Opportunity Employer. Closing date is October 30, 1985 or until filled.

#130 THREE ASSISTANT PROFESSORSHIPS, tenure-leading, available August 1986. Will teach, do research and provide service in accounting. Requires Ph.D. or DBA. CPA or CMA desirable. Apply by March 1, 1986, with vita and names of three references to: Dr. Tom Balke, Search Chair, School of Accountancy, College of Business Administration, University of Nebraska-Lincoln, 137 CBA, Lincoln, Nebraska 68588-0488. Affirmative Action/Equal Opportunity Employer.

#131 UNIVERSITY OF NEW ORLEANS invites applications for the position of Assistant or Associate Professor of Accounting. Candidates should have the Ph.D. or DBA degree. Evidence of excellence in teaching, research, and professional activities is necessary. Salary is negotiable and competitive. The University offers the M.S. in Accounting and the M.S. in Accounting (tax option), as well as the M.B.A. Approximately 700 undergraduate accounting majors are enrolled. The University has AACSB accreditation at both the undergraduate and graduate levels. Candidates should send resumé to Professor R. J. Thacker, Chairman, Department of Accounting, College of Business Administration, University of New Orleans, New Orleans, LA 70148. UNO is an Affirmative Action, Equal Opportunity Employer.

#132 GEORGE WASHINGTON UNIVERSITY, Department of Accountancy, invites applications for tenure-track positions in accounting. Candidates are expected to possess a doctoral degree or be near completion of degree and should be dedicated to teaching excellence and research. GWU is an equal opportunity, affirmative action employer. Please send vita to Professor Michael Gallagher, Chairman, Department of Accountancy, George Washington University, 710 21st Street, NW, Room 209, Washington, DC 20052. Telephone (202) 676-6825.

#133 SALISBURY STATE COLLEGE is seeking applications for a faculty position at the Assistant or Associate rank in Accounting. Preference will be given to persons holding the Ph.D. or DBA degree or expecting completion by September 1986. Salisbury State College is an Affirmative Action/Equal Opportunity Employer. Please send vita to Dr. Gary Lee Pielemeier, Dean, School of Business, Salisbury State College, Salisbury, MD 21801.

#134 CALIFORNIA STATE UNIVERSITY, NORTHRIDGE (situated in the northwest corner of the City of Los Angeles), anticipates full-time faculty openings at the ranks of Professor and Lecturer for the academic year 1986–87. The Department offers BS and MS degree options in both Accounting Theory and Practice and MIS. Doctorate in Accounting required for tenure and promotion. CPA or CMA certificate desired. Salary level $22,116–$50,100, commensurate with qualifications and experience. We are an equal opportunity/affirmative action, Title IX, Section 504 employer. Address inquiries to: Donald L. Raun, Department Chairman, Department of Accounting and MIS, School of Business, CSUN, Northridge, CA 91330. Application deadline: January 15, 1986, or until positions are filled.

#135 UNIVERSITY OF CINCINNATI, College of Business Administration, seeks candidates for tenure-track faculty positions in the Department of Accounting. Candidates for Assistant Professor should have doctorate or be in advanced dissertation stage; evidence of research and teaching potential is required. Professional certification and business experience is desirable. Send resumé to: Dr. Donald E. Ricketts, University of Cincinnati, College of Business Administration, Department of Accounting/Business Law, Cincinnati, Ohio 45221-0130. The University of Cincinnati is an Affirmative Action/Equal Opportunity Employer.

#136 TENURE-TRACK, Professorial rank to teach Accounting. Competence in Management, Finance or Law a plus. Salary to $58,000, dependent on qualifications. Ph.D. preferred, CPA/Master's acceptable. Start September 1986. Send resumé to: Edward O. Lutz, Chairman, Economics Department, Brooklyn College, CUNY, Brooklyn, NY 11201. An AA/EO Employer.

#137 DEPARTMENTAL CHAIR: Rider College announces a search for the chair of the Accounting Department to be filled by September 1986. The Department has 13 full-time members and emphasizes teaching excellence along with scholarship and service. The Department has an excellent reputation for graduating well-qualified professional accountants and has a strong relationship with the professional community. The candidate is expected to have an appropriate terminal degree and to offer a considerable amount of energy and enthusiasm to further enhance the school's reputation. Candidates should contact Professor Samuel Laibstain, Rider College, 2083 Lawrenceville Road, Lawrenceville, NJ 08648 by January 17, 1986. Rider College is an Equal Opportunity, Affirmative Action Employer M/F/H.

#138 THE UNIVERSITY OF MICHIGAN-FLINT, School of Management, invites applications for a permanent, tenure-track faculty position in ACCOUNTING. Rank is dependent upon qualifications. Salary and benefits very competitive. Teaching in both BBA and MBA programs. Ph.D./DBA with CPA/CMA preferred. ABD required. To teach auditing, managerial accounting, and/or management information systems. Position available September 1986 or January 1987. UM-Flint is a non-discriminatory, affirmative action employer. Send resumé to Dean Richard W. Fortner, School of Management, The University of Michigan-Flint, Flint, Michigan 48503 or call (313) 762-3164.

#139 POSITION WANTED: M.B.P.A., C.P.A., six years auditing experience, one year full-time teaching experience. Teaching interests include: Principles, Auditing, Management Accounting, and Financial Accounting.

#140 ALL POSITIONS, tenure-track, for the 1986–87 year. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, Department of Accounting, North Texas State University, Denton, Texas 76203. NTSU is an Equal Opportunity, Affirmative Action Employer.

#141 ACCOUNTING/INTERDISCIPLINARY STUDIES: Guilford College, Dana Faculty Fellow. Assistant Professor, tenure-track position beginning fall 1986, funded in part by the Dana Foundation. Strong commitment to teaching undergraduates at a small liberal arts college; interest in financial accounting and in teaching and participating in the development of interdisciplinary courses. Doctorate and CPA (or candidacy) preferred. Guilford is a selective, co-educational Quaker liberal arts college. We actively seek applications from women and minorities. Send statement of interest and vita by February 15 to Dr. Samuel Schuman, Academic Dean, Guilford College, Greensboro, NC 27410.

#142 CHAIR POSITION. MARQUETTE UNIVERSITY is seeking Chairman for the Department of Accounting starting August 1986. Candidates should have a Ph.D. (or equivalent) and be qualified for appointment at either Full or Associate Professor. The chair is expected to provide leadership to a fifteen-member department offering a full range of undergraduate accounting courses and graduate courses in the Master of Accounting Science and MBA programs. Candidates should have a proven record in teaching, research, and service. Salary is competitive and depends on credentials and experience. Send resumé to Dr. Robert Yahr, Chair, Accounting Chairman Search Committee, College of Business Administration, Marquette University, Milwaukee, WI 53233 by February 1, 1986. Marquette University is an Equal Opportunity/Affirmative Action Employer.

#143 POSITIONS AVAILABLE AT THE UNIVERSITY OF NORTH DAKOTA at the Associate or Full Professor level for January or August 1986. Should have the doctorate and also an interest in research and publication. Salary competitive. Send resumé to: Professor Ludwik Kulas, Chairman, Department of Accounting and Business Law, College of Business and Public Administration, University of North Dakota, Grand Forks, ND 58202. An Equal Opportunity/Affirmative Action Employer.

#144 TEMPLE UNIVERSITY seeks applicants for accounting faculty positions. Rank is dependent on candidate's qualifications. Salaries are competitive, fringe benefits are excellent. Candidates should hold a doctorate in accounting or be ABD with substantial progress toward completion. CPA or CMA is a plus. The Department desires well-balanced performance by its faculty, including teaching excellence, publications and service. BBA, MBA, MS in Tax and Ph.D. programs are offered. Temple University is located in historic Philadelphia and is a short drive from the Pocono Mountains and the Jersey shore. Apply to: Dr. Stephen L. Fogg, Chairman, Department of Accounting, School of Business Administration, Temple University, Philadelphia, PA 19122. Telephone (215) 787-1915. Temple University is an equal opportunity, affirmative action employer. Qualified minorities and women are encouraged to apply.

#145 POSITION WANTED: Southeast United States, Ph.D., CPA, 30 years teaching experience, Taxation and Financial Accounting, agreeable to Visiting Professorship and/or one-year appointment.

#146 ACCOUNTING: Tenure-track position; rank—Assistant or Associate; beginning Fall 1986. Requirements: Ph.D. or DBA in accounting with CPA or CMA. Area: Managerial or Financial. Send resumé to Dr. John Fulmer, Head, Department of Accounting and Finance, University of Tennessee at Chattanooga, Chattanooga, Tennessee 37403. The University of Tennessee at Chattanooga is an Equal Opportunity, Affirmative Action Employer and invites applications from all qualified individuals.

#147 POSITION WANTED: BBSc, MBA, CPA, former IRS Appeals Officer (21 years), Cleveland State University (7 years), Lecturer, Case Western Reserve University (18 years) desires teaching position Fall 1986. Extensive experience in teaching basic and advanced income taxes as well as financial accounting. Write Edward Alpern, 5596 Mayfield Road, Lyndhurst, Ohio 44124.

#148 VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY invites applications and nominations for the *Peat Marwick Professorship in Accounting*. Applicants/nominees should have a demonstrated record of excellence in research and teaching. The appointment will be at the senior level with compensation and research supplements provided by the professorship. The search will close on March 1, 1986. Applications and nominations should be sent to: Wayne E. Leininger, Department of Accounting, 222 Burruss Hall, Virginia Tech, Blacksburg, VA 24061. Virginia Tech is an Equal Opportunity/Affirmative Action Employer.

#149 THE UNIVERSITY OF MANITOBA is seeking applicants for tenure-track positions in accounting for July 1986. Rank is open, based on qualifications and experience. A visiting appointment is also possible. Ph.D. or DBA, completed or near completion, is required. Duties include research and teaching at the undergraduate and graduate levels. Salary is competitive and will depend on qualifications, experience, and research record. Winnipeg, a multicultural city of 600,000, offers the best of an urban environment in the heart of Canada's vacation land. Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to qualified Canadian citizens and permanent residents of Canada. Applications should be sent to: Dr. L. I. Gould, Head, Department of Accounting and Finance, University of Manitoba, Winnipeg, Manitoba R3T 2N2.

#150 POSITION WANTED. Ph.D., several years of teaching experience in areas of financial, managerial, and systems. Wish to relocate to a school that not only requires quality teaching and research, but also has facilities for and supports such activities.

#151 CALIFORNIA STATE UNIVERSITY, CHICO, Department of Accounting and Management Information Systems within the School of Business has a faculty vacancy for a tenure-track position in the areas of auditing, taxation, and management information systems. Candidates must have a Ph.D. or DBA. Teaching performance, scholarly productivity, and university service record are essential attributes for appointments at advanced rank. The Department offers graduate and undergraduate accounting degrees and a program in Management Information Systems. The M.B.A. and Business baccalaureate programs are AACSB accredited. CSU, Chico is located in Northern California, with outstanding summer and winter sports available. Housing costs in Chico approximate midwestern metropolitan levels. Send resumé to Dr. Lee Pryor, Professor and Chair, Department of Accounting and Management Information Systems, California State University, Chico, CA 95929-0011. CSU, Chico is an Affirmative Action/Equal Opportunity Employer.

#152 UNIVERSITY OF CALIFORNIA, IRVINE: Applications invited for a tenure-track appointment, at Assistant Professor level, in Graduate School of Management. Doctoral degree (or nearly completed one) in field of accounting required. CPA certificate desirable, must have strong capability in research. Teaching primarily at Masters and Ph.D. level. Competence in one or more associated fields, such as artificial intelligence, cognitive science, or management information systems, is highly desirable. Please send resumé, names of at least three references and letter outlining teaching and research interests to: Dean Newton Margulies, Graduate School of Management, University of California, Irvine, CA 92717. Affirmative Action/Equal Opportunity Employer. Closing date: December 1, or until position filled.

#153 ACCOUNTING. Berea College. Instructor or Assistant Professor. Tenure-track, beginning Fall 1986. M.B.A. or equivalent, CPA preferred. Business, government or teaching experience and additional graduate work expected for appointment as Assistant. Teaching responsibilities in undergraduate accounting and business courses. Berea is a unique college with special commitments to a quality educational program with a liberal arts foundation, the Appalachian region, interracial education, and an understanding of Christian traditions. All students work in a labor program. Send resumé, transcripts and arrange for three confidential letters of recommendation to be forwarded prior to February 1, 1986, to Dr. C. B. Sowell, CPO 2300, Berea College, Berea, KY 40404.

#154 THE UNIVERSITY OF WISCONSIN-PARKSIDE invites applications for a tenure-track position in Accounting, at the Assistant or Associate Professor level, starting in August 1986. Candidates should have appropriate doctorate (ABD will be considered) and a commitment to teaching and research. Teaching responsibilities include graduate and undergraduate accounting courses. Salary is competitive and commensurate with qualifications and experience. The University is located about thirty miles south of Milwaukee. Applications accepted until position is filled. Send resumé and three references to Dr. Arthur L. Dudycha, Chairperson, Division of Business and Administrative Science, Box No. 2000, Kenosha, WI 53141-2000. An equal opportunity/affirmative action employer.

#155 UNIVERSITY OF LOUISVILLE. *Assistant/Associate Professor of Accounting.* Appointments as Assistant/Associate Professor of Accounting are available in the School of Business. Minimum qualifications for Assistant are: A Ph.D. or DBA, demonstrated potential for teaching effectiveness and demonstrated potential for quality research capabilities. ABDs will be considered. Minimum qualifications for Associate are: A Ph.D. or DBA, demonstrated teaching effectiveness, and demonstrated quality research capabilities. Beyond minimal qualifications, preference will be given for possession of CPA or CMA. Preferred areas of teaching and research are auditing and financial accounting. Deadline for application is January 31, 1986. If you wish to take advantage of this opportunity, send your vita to: Dr. Alan Attaway, Chairman, Department of Accountancy, School of Business, University of Louisville, Louisville, Kentucky 40292. *An Equal Opportunity/Affirmative Action Employer.*

#156 TAXATION/BUSINESS LAW POSITION WANTED for Fall 1986. Several years teaching tax and law courses and Big 8 experience. Write for resumé.

#157 LA SALLE UNIVERSITY—Assistant/Associate Professor of Accounting (tenure-track). Doctorate or advanced doctoral candidate in accounting or related discipline willing to teach Financial Accounting, Managerial Accounting, or Taxation. Professional and/or teaching experience desirable. Duties will include teaching at the undergraduate and graduate levels, involvement in research and publishing, and advising students. Institutional support for faculty retraining in accounting. Salary competitive. Excellent fringe benefits. Send resumé and suggested references to: Jack Zook, Assistant Chairperson, La Salle University, Philadelphia, PA 19141.

#158 NORTH CAROLINA STATE UNIVERSITY invites applications for a tenure-track position in accounting beginning in the fall of 1986. An earned doctorate is required although advanced ABDs will also be considered at the Assistant Professor level, and professional certification is highly desired. Important qualifications include demonstrated interest in and ability to do publishable research, and a commitment to teaching excellence. Please send resumés to Professor E. H. Brooks, Accounting Search Committee, Department of Economics and Business, North Carolina State University, Box 8110, Raleigh, North Carolina 27695-8110. North Carolina State University is an equal opportunity/affirmative action employer.

#159 TAXATION POSITION WANTED. J.D./M.Acc.-Tax/C.P.A., with three years teaching experience, desires a position teaching taxation. Prefer a university with a doctoral program which could be pursued part-time while teaching full-time. Good credentials and recent publications.

#160 ELON COLLEGE has an open senior level, tenure-track position in financial and managerial accounting. Applicants should have a Ph.D. in accounting (or related discipline), CPA or CMA qualification, teaching experience, and non-academic work experience. The position involves both undergraduate and graduate teaching, leadership in curriculum planning and development, and interaction with the private sector. Rank and salary are negotiable. Elon College is one of North Carolina's foremost private coeducational colleges. Located in the town of Elon College, adjacent to the city of Burlington, the College is situated near Interstate Highway 85, approximately 15 miles east of Greensboro and 30 miles west of the Durham-Raleigh metropolitan area. Send letters of application and resumés to: J. M. Marr, Campus Box 2176, Elon College, Elon College, NC 27244. Elon College is an Equal Opportunity/Affirmative Action Employer.

#161 CHAIRPERSON, THE UNIVERSITY OF TOLEDO. The Department of Accounting invites nominations and applications for the departmental chairperson effective September 1, 1986. Candidates should possess a doctorate, preferably with accounting as a major area of study. Applications should have established credentials sufficient to support a senior level faculty appointment. Salary for the appointment is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The campus is located in an excellent neighborhood which enables many of the faculty to walk to their offices. The Accounting Department offers an undergraduate degree in accounting, as well as a Master of Science in Accounting degree and the MBA. Send vita to: Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, OH 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

#162 POSITION WANTED. Available Spring or Fall 1986. Retiring professor seeks visiting teaching appointment in accounting.

#163 HARVARD UNIVERSITY Graduate School of Business Administration announces faculty positions opening July 1, 1986 for assistant professors in the Control Area to teach graduate financial and managerial accounting and information systems management. Positions entail substantial case-method teaching at graduate and executive program levels and strong potential and interest in field-based case/course development and research significant to academics, management, and the accounting profession. Salary and fringe benefits are fully competitive. Last year, salary for entry-level assistant professors was $39,500. Submit current vitae; full transcripts of undergraduate and graduate work; copies of publications, including cases written; description of courses taught, particularly those where case-method teaching has been done; statement of why applicant is specifically qualified for position; and list of references to Ms. Marrilyn G. Reid, Administrator for Faculty Appointments and Procedures, Harvard University Graduate School of Business Administration, Soldiers Field, Boston, MA 02163. Harvard University is an affirmative action/equal opportunity employer.

#164 ACCOUNTING POSITION—THE UNIVERSITY OF AKRON. Faculty vacancy at the assistant/associate level, beginning September 2, 1986. Earned doctorate (Ph.D. or DBA) and CPA, CMA or CIA preferred. ABDs also invited to apply. Candidates should be dedicated to teaching excellence and have an interest in both professional activities and research. The Department of Accounting offers the BS, MBA, and MS degrees in Accounting, as well as a Master in Taxation. Undergraduate and graduate programs in business are AACSB accredited. Consideration will be given to all vitas received by March 1, 1986. Please mail to: Dr. Richard S. Roberts, Head, Department of Accounting, College of Business Administration, The University of Akron, Akron, OH 44325. The University of Akron is an Equal Education and Employment Institution.

#165 CHAIRPERSON—Accounting, College of Business, Northern Kentucky University, Highland Heights, KY 41076 (seven miles from downtown Cincinnati). Ph.D. or DBA required; CPA, CMA, or CIA desirable. Candidates should be tenurable as associate or full professor. Rank and salary competitive based on qualifications. The chairperson provides academic leadership and develops relationships with the areas of public accounting firms, industry, and professional community. The accounting department has 8 faculty and about 350 majors. Send resumé and references by January 21, 1986 to Dr. Y. Datta, Chairman, Search Committee, at the above address. Telephone: (606) 572-6526. NKU is an Affirmative Action/Equal Opportunity Employer and actively seeks the candidacy of minorities and women.

#166 TAXATION, GEORGE MASON UNIVERSITY. The Department of Accounting and Business Legal Studies invites applications for a position in taxation effective September 1, 1986. Candidates should possess a doctorate in Accounting, with taxation as a major area of study; ABDs will also be considered. Salary for the appointment is very competitive. George Mason University, the State University of Northern Virginia, is located approximately 20 miles west of Washington, D.C. The University is a dynamic, growing institution with 16,000 students. The School of Business Administration has over 3,400 graduate students, of which over 400 are accounting majors. Graduate offerings include an established MBA program and a new M.S. in Accounting program. The Search Committee will begin considering candidates immediately. Inquiries or applications should be sent to: Dr. Phillip G. Buchanan, Acting Chair, Department of Accounting and Business Legal Studies, School of Business Administration, George Mason University, 4400 University Drive, Fairfax, VA 22030. George Mason University is an AA/EOE employer.

#167 THE UNIVERSITY OF THE DISTRICT OF COLUMBIA is currently searching for accounting faculty at the rank of Associate or Full Professor. Appropriate doctoral degree required, as well as teaching and/or business experience, and record of scholarly productivity. UDC is the land-grant university for the District of Columbia and is an equal opportunity employer. Residency must be established in the District of Columbia. The nation's capital offers many scholarly and cultural advantages. Consulting is encouraged within university policies. Please send resumé, transcripts, and letters of recommendation to Dr. Harry Mathis, Department of Accounting, University of the District of Columbia, 900 F Street, N.W., Washington, DC 20004. Phone (202) 727-2230.

#168 KANSAS STATE UNIVERSITY seeks applicants for two anticipated positions at the rank of Assistant or Associate Professor. Ph.D. or DBA preferred. Doctoral candidates within one year of completion will be considered. Appointment at Associate level requires four or more years of post-doctoral experience and significant publications. Final review of applicants will begin February 15, 1986. Kansas State University, Department of Accounting, Calvin Hall, Manhattan, Kansas 66506. Affirmative Action, Equal Opportunity Employer.

#169 UNIVERSITY OF MISSOURI-ST. LOUIS has tenure-track positions; rank and salary dependent on qualifications. Most interest areas can be accommodated, though candidates in financial, managerial, governmental or systems preferred. Quality research and teaching expected. Candidates should possess Ph.D./DBA. Professional certification desirable. ABDs considered for junior position. Senior appointment requires strong publication record. UMSL enrolls over 3,000 students in AACSB-accredited undergraduate and master business programs. Pleasant suburban location. Submit resumé or inquiries to David R. Ganz, Coordinator, Accounting Area, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121 (an affirmative action, equal opportunity institution).

#170 CALIFORNIA POLYTECHNIC STATE UNIVERSITY-SAN LUIS OBISPO seeks candidates for Fall 1986 appointments in tenure-track faculty positions in accounting, with primary teaching interests in managerial/cost and financial accounting. Ph.D. or DBA with major in accounting required. Practical experience and professional certification preferred. Candidates must be committed to teaching excellence and professional development including research, publication, and professional service. Teaching responsibilities include the undergraduate and MBA programs. Rank and salary commensurate with qualifications and experience. Interested persons should send resumé with list of references to: Dr. William C. Boynton, Accounting Department Head, School of Business, California Polytechnic State University, San Luis Obispo, CA 93407. Closing date: January 31, 1986, or until filled. California Polytechnic State University is an Affirmative Action/Equal Opportunity Employer.

#171 THE UNIVERSITY OF WISCONSIN-RIVER FALLS, Department of Business Administration, College of Arts and Sciences, announces a tenure-track position in Accounting. *Description of Position:* The position includes a teaching load of 12 credits per quarter, typically involving 2-3 preparations in accounting courses. The candidate for this position will be expected to teach courses including principles of accounting, intermediate accounting, and other financial accounting courses. An interest in accounting systems would be helpful. *Qualifications:* Ph.D. in Business Administration or D.B.A or A.B.D. with Accounting emphasis. M.B.A. with Accounting emphasis and Master's degree in Accounting may be considered for rank of instructor or academic staff, although earned doctorates are preferred. *Rank and Salary:* Depends upon the candidate's academic training and appropriate experience. *Length of Appointment:* September 1, 1986 through May 31, 1987, and may be renewed. *Application Deadline:* January 1, 1986 or until position is filled. *Inquiries and Resumé Should be Directed to:* Young J. Kim, Chairman, Department of Business Administration, University of Wisconsin-River Falls, River Falls, WI 54922. (715) 425-3335. The University of Wisconsin-River Falls is an equal opportunity employer and actively seeks applications from all qualified persons regardless of race, color, creed, sex, age, or national origin.

#172 CHAIR, Department of Accounting & Management Science, California State University, Chico, starting Fall 1986. Candidates should have a doctorate in accounting and be qualified for appointment at full professor. The chair is expected to provide leadership to a 24-person department faculty offering a full complement of courses in accounting, management information systems, and management science. The School of Business, one of nine academic units within the university, is fully accredited by the AACSB. The department offers programs and courses in accounting, management science, and management information systems leading to B.S., M.B.A., and M.S. in Accounting degrees. Candidates should have a proven record in teaching, research and service and have the ability to work with professionals in practice and industry. Interested persons should send their resumé and at least five references (name, address and telephone number) to Dr. Karl Brugger, Department of Accounting & Management Science, School of Business, California State University, Chico, Chico, CA 95929, by February 10, 1986. CSU, Chico is an Equal Opportunity/Affirmative Action Employer.

#173 DIRECTOR, SCHOOL OF ACCOUNTANCY. The Wichita State University invites applications for the position of Director, School of Accountancy, beginning Fall 1986. Candidates should have an earned doctorate and be qualified at the full or associate professor rank. Candidates should possess efficient administrative skills, a record of effective teaching, demonstrated research ability, effective communication skills, and ability to work with professionals in practice and industry. Please submit resumé and references by February 1, 1986, to: Dr. Katherine Moffeit, Chairman, Search Committee, School of Accountancy, College of Business Administration, The Wichita State University, Wichita, Kansas 67208. Equal Opportunity/Affirmative Action Employer.

#174 COLLEGE OF THE HOLY CROSS—Tenure-track faculty position available September 1986 to teach cost, auditing, and principles of accounting. Appointments will be considered in all ranks. Nine hours of teaching per semester, two preparations, with some emphasis on research, publication. Applicants should preferably possess or be close to completing Ph.D. or D.B.A., but MBA-CPA will be considered. Salary very competitive. Forward resumé, graduate transcripts, names of three references to Prof. John D. O'Connell, Economics Department, College of the Holy Cross, Worcester, Massachusetts 01610. (617) 793-2679. Holy Cross is a Jesuit liberal arts college. Equal Opportunity/Affirmative Action Employer.

#175 VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY (Virginia Tech) has a faculty position in accounting available beginning September 1986 at the Northern Virginia Graduate Center in Falls Church, Virginia. Candidates should have a Ph.D. and a research orientation. Appointments at any rank will be considered. Faculty members will teach a variety of accounting courses to MBA students. Falls Church is convenient to Washington, DC and is an attractive location for data collection and consulting. Virginia Tech is an Equal Opportunity Employer. Send resumés to Wayne E. Leininger, Department of Accounting, 222 Burruss Hall, Virginia Tech, Blacksburg, VA 24061.

#176 ACCOUNTING POSITION—Associate Professor or Professor of Accounting depending upon amount of education, level of teaching experience and professional experience. Applicants are expected to demonstrate excellence in teaching, success in research leading to publication, and a willingness to participate in public service activities. Position to be filled Fall 1986. Salary is competitive. Affirmative Action/Equal Opportunity Employer. Contact: Director, School of Accountancy, Mississippi State University, P.O. Drawer EF, Mississippi State, MS 39762.

#177 INSEAD-THE EUROPEAN INSTITUTE OF BUSINESS ADMINISTRATION is seeking to expand its accounting and control faculty. Expansion is required to meet the growing demands of MBA and executive programmes and to respond to research opportunities. Career and visiting positions are available at all ranks. Conditions of employment are competitive and negotiable. There is a tenure system for senior faculty. Successful candidates will have or be completing a Ph.D. (or equivalent), be managerial in orientation, enjoy teaching MBAs and executives, use microcomputers in their courses and be active in positive accounting research. The primary language of instruction is English. Reply to: Deigan Morris, Area Coordinator, Accounting and Control Area, INSEAD, Boulevard de Constance, 77305 Fountainebleau Cedex, France.

#178 EASTERN ILLINOIS UNIVERSITY. Assistant or Associate Professor of Accounting. Tenure-track position. Ph.D. in Business with accounting major required. Teaching load reduction possible for those researching and publishing. Class assignments are flexible (depending on program needs), but auditing, governmental, and financial are primary needs. Salary is dependent upon qualifications and experience with net pay being very competitive since Eastern is not under Social Security and the pension plan is tax-sheltered. For further information contact: Dr. Lowell D. Bourne, Chair, Department of Accountancy, Data Processing and Finance, Eastern Illinois University, Charleston, IL 61920; (217) 581-3023. An Affirmative Action/Equal Opportunity Employer.

#179 TENNESSEE TECH UNIVERSITY announces a new position in the Department of Accounting. All levels invited to apply. Doctorate required, professional certification preferred; for Associate/Full, appropriate level of scholarly achievement required. Salary competitive with AACSB "public accredited" schools; among fringe benefits is ongoing in-house microcomputer training program for accounting faculty. Opening is for Fall 1986. Position open until filled. Contact: Dr. Russell C. Kick, Jr., Chairperson, Department of Accounting, P.O. Box 5024, Tennessee Tech University, Cookeville, TN 38505. TTU is an Equal Opportunity/Affirmative Action Employer.

#180 THE UNIVERSITY OF WISCONSIN-PARKSIDE invites applications for a tenure-track position in Accounting, at the Assistant or Associate Professor level, starting in August 1986. Candidates should have appropriate doctorate (ABD will be considered) and a commitment to teaching and research. Teaching responsibilities include graduate and undergraduate accounting courses. Salary is competetive and commensurate with qualifications and experience. The University is located about thirty miles south of Milwaukee. Applications accepted until position is filled. Send resumé and three references to Dr. Arthur L. Dudycha, Chairperson, Division of Business and Administrative Science, Box No. 2000, Kenosha, WI 53141-2000. An equal opportunity/affirmative action employer.

#181 THE UNIVERSITY OF EVANSVILLE invites applications for an Assistant/Associate Professor of Accounting in the areas of auditing, accounting theory or cost accounting. The candidate is not expected to teach in all three areas. The University of Evansville is a small private institution. Excellence in classroom teaching is expected, along with a reasonable complementary research focus. Please send a vita to Dr. Dale Hockstra, Dean, School of Business Administration, University of Evansville, 1800 Lincoln Avenue, Evansville, IN 47714 or call 812-479-2853.

#182 UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE—Assistant Professor of Accounting for Fall 1986. Ph.D. in Accounting preferred; salary competitive. Successful applicant will teach undergraduate accounting classes, serve on departmental and institutional committees, and be involved in professional activities. The UNCA Accounting Program emphasizes good teaching that will prepare students to pass the certifying exams. UNCA is located in the beautiful Western North Carolina mountains. Send resumés to A. T. Hollingswort, Ph.D., Chairman of Management Department, UNC-Asheville, Asheville, NC 28804. UNCA is an AA/EEO employer. Application review begins January 15.

#183 CHAIRPERSON. Western Illinois University is seeking a Chairperson for the Department of Accountancy, effective July 1, 1986. Applicants must possess an earned doctorate with emphasis in accountancy. Professional accounting certifications and AACSB accreditation must have demonstrated administrative, teaching and research skills in accountancy in a university environment. The 15-member department of accountancy is one of five in the college of business which is accredited by the AACSB at undergraduate and graduate levels. Salary and rank commensurate with qualifications. Interested parties should submit a resumé and letter of application to Kenny L. Loquist, Search Committee Chair, Department of Accountancy, Western Illinois University, Macomb, Illinois 61455. AA/EOE.

#184 GETTYSBURG COLLEGE, Department of Management, invites applicants for two tenure-track positions at the Assistant Professor level. Minimum requirement is a Ph.D./D.B.A. in accounting or substantial progress toward that degree, with CPA/CMA desired. Apply by January 27, 1986 with letter of application, curriculum vitae, and letters of reference to William E. Rosenbach, Box 395, Gettysburg College, Gettysburg, PA 17325-1486. Gettysburg College is a selective liberal arts college related to the Lutheran Church of America and is an Affirmative Action, Equal Opportunity Employer. Women and members of minority groups are encouraged to apply.

#185 THE UNIVERSITY OF MARYLAND European and Asian Divisions seek excellent teachers for undergraduate courses on U.S. military bases overseas. Minimum requirements include a master's in accounting, one year of recent college teaching experience, and U.S. citizenship. Renewable annual appointments begin August 1986. Excellent for a sabbatical or leave of absence. Benefits include transportation, a currency adjustment allowance, and military base privileges. Frequent travel and the cost of schooling make these positions difficult for those with children. Send resumé to Dr. Lois A. Mohr, The University of Maryland University College, College Park, MD 20742. AA/EOE.

#186 ACCOUNTING: THE UNIVERSITY OF SOUTHERN MISSISSIPPI-GULF PARK invites applications for a tenure-track faculty position in Accounting. Tenure-track appointment require the completion of the Ph.D. or the D.B.A. ABD applicants will be considered for the position as non-tenure-track faculty pending the completion of the Ph.D. or D.B.A. Duties for the position include teaching, research, and service. The University of Southern Mississippi Gulf Park is a regional campus of the University of Southern Mississippi and is located on the Mississippi Gulf Coast in Long Beach. The regional campus Division of Business Administration offers the baccalaureate and master's degrees in business administration. The baccalaureate program includes options in finance, general business, management, marketing, and real estate. Salary for the position is competitive for the region. Resumés, complete with official transcripts and three letters of recommendation, should be received by February 21, 1986. Address applications to Dr. Joe Holloway, Dean, University of Southern Mississippi Gulf Park, Long Beach, Mississippi 39560. AA/EOE.

#187 RIDER COLLEGE invites applications for positions in accounting starting in September 1986. Teaching and research are emphasized for promotion and tenure. Preference is given to persons possessing appropriate doctoral degree or ABD. Rider College offers an MBA program and undergraduate degree programs in accounting and nine other areas. The Accounting Department currently has 14 full-time faculty and 600 majors. Rider College is located five miles south of Princeton in an attractive residential area. Please send vita to Dr. Marianne Battista, Accounting Department, Rider College, 2083 Lawrenceville Road, Lawrenceville, NJ 08648-3099. Rider College is an equal opportunity/affirmative action employer.

#188 VALDOSTA STATE COLLEGE, School of Business Administration is recruiting faculty for September 1986. Emphasis in auditing preferred, but other qualified faculty will also be considered. Doctorate required; certification desirable. Competitive salaries commensurate with experience and education. Valdosta State College offers undergraduate and masters degrees in business with an undergraduate major in Accounting. Apply to Professor Don Seat, School of Business Administration, Valdosta State College, Valdosta, Georgia 31698. An Affirmative Action/Equal Opportunity Employer.

#189 PORTLAND STATE UNIVERSITY, located in Portland, Oregon, invites applications for a permanent appointment in accounting. The available position is at the Assistant or Associate level. Research and teaching in taxation or managerial accounting required. Applicants must possess a doctoral degree in accounting, although candidates at an advanced dissertation state will also be considered. Performance evaluation at PSU is based upon a judicious blend of effective classroom teaching, research and publication, and university and community service. The standard teaching load is 9 quarter hours. Programs are offered at both the undergraduate and graduate levels. The department enjoys a very close relationship with the professional accounting community in the state. Vita should be directed to Dr. Richard H. Visse, Head, Department of Accounting, Portland State University, Portland, Oregon 97207. Application deadline is January 31, 1986. PSU is an equal opportunity, affirmative action employer. Qualified minorities, women, and members of other protected groups are encouraged to apply.

#190 THE UNIVERSITY OF WISCONSIN-GREEN BAY announces the availability of one accounting faculty position effective Fall 1986. Candidates must possess earned doctorate in accounting or be ABD in the dissertation stage of their doctoral work. Position entails teaching courseload of nine credits per semester in either financial or managerial accounting areas. Teaching releases are available for research projects. Salaries will be highly competitive with other salaries in the United States for comparable positions. contact Dr. Karl M. Zehms, Chairman, Program in Accounting, University of Wisconsin-Green Bay, Green Bay, WI 54301. Telephone (414) 465-2051. The University is an Equal Opportunity/Affirmative Action Employer.

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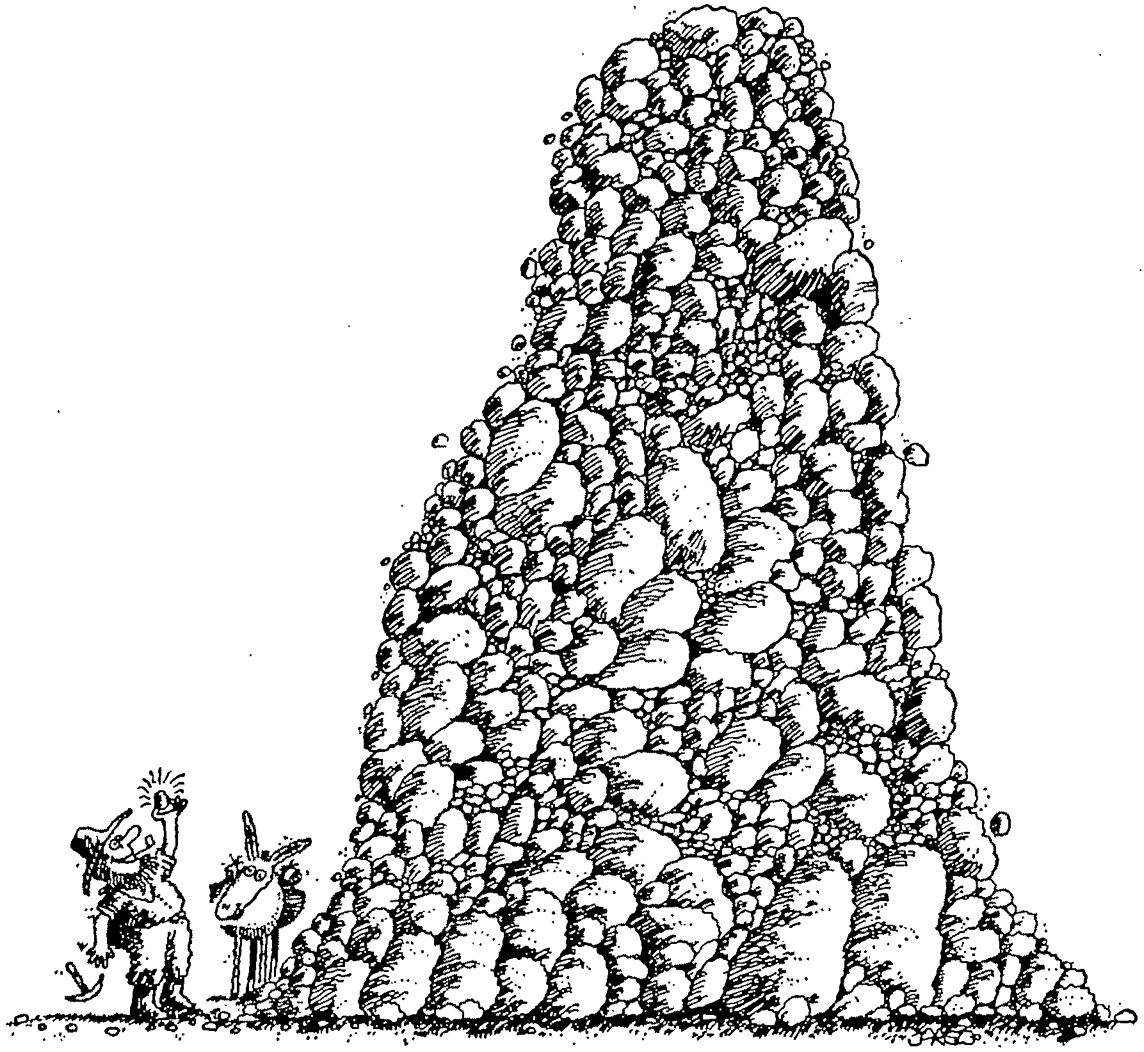

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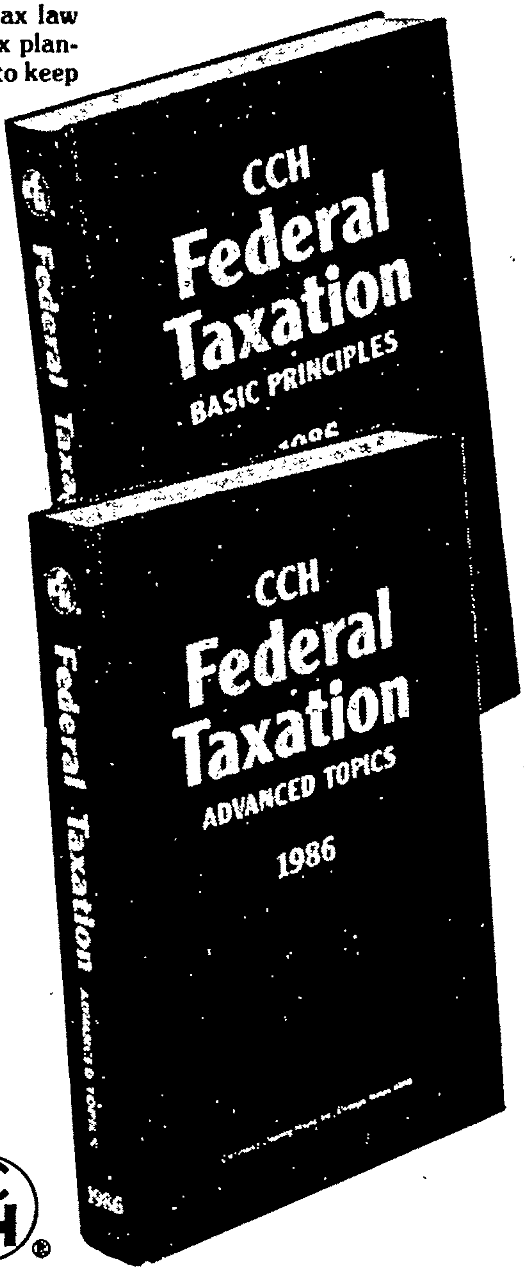

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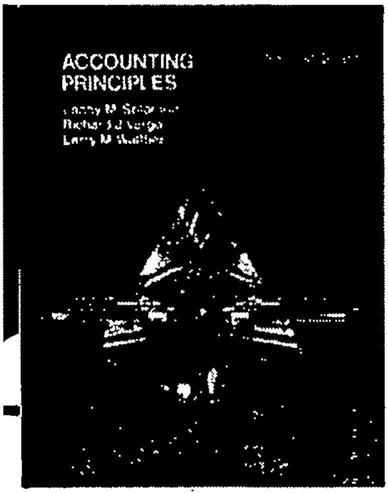

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RESEARCH STUDY #18

TRIPLE-ENTRY BOOKKEEPING AND INCOME MOMENTUM

BY YUJI IJIRI

Is double-entry bookkeeping "absolutely perfect" as it has been claimed? Would it not be possible to extend it logically to triple-entry bookkeeping? If so, what would be the dimension that is destined to become the third dimension in the triple-entry system?

It is trivial to add an arbitrary third dimension and call it triple-entry bookkeeping, since if anything can appear as the third dimension, there is no room for theory, even if the resulting system is useful from a practical standpoint. The essential requirement for a solution to the double-entry problem is, therefore, that the third dimension must be logically deducible from the existing two dimensions (the debit and the credit) of double-entry bookkeeping.

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The results indicated that, on an overall basis, respondents placed more emphasis upon conceptual knowledge than upon technical ability. Also, significant differences between importance responses of educators and practitioners were found for a majority of the questionnaire topics. The author discusses some implications of these and other findings in the concluding chapter and raises questions which can best be addressed through additional research. Also included in the publication is a lengthy bibliography which should be useful to researchers dealing with accounting education issues.

The findings should be interesting and useful to educators responsible for evaluating and developing accounting curricula. Likewise, textbook authors should find the study useful. The findings should also be of interest to accounting practitioners.

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Sample Error Characteristics and Projection of Error to Audit Populations

David Burgstahler and James Jiambalvo

ABSTRACT: This paper examines the practice of "isolating" certain errors observed in an audit sample and subsequent failure to project the errors in estimating total error in an audit population. An abstract (normative) model of inference is developed to analyze this practice and related descriptive theories of human information processing are reviewed. Previous descriptive research suggests that auditors may be inclined to isolate errors that are considered to be "unique." However, the normative analysis suggests that isolation is seldom appropriate. The responses of auditors to a number of hypothetical cases are analyzed to provide descriptive empirical evidence on the practice of error isolation. The responses indicate a strong tendency to isolate errors whose cause is perceived as "unique." An analysis of isolation/projection decisions as a function of firm membership, experience, and training in statistics indicates that the tendency to isolate errors is, for individual cases, related to firm membership and experience. However, the observed firm membership and experience effects are not consistent across all cases. Thus, the results are not well explained by a simple model which posits that inappropriate error isolation is limited to a few firms or to inexperienced auditors. While incorrect error isolation appears to be prevalent in practice, we suggest several factors which may mitigate its adverse effects.

STATEMENT on Auditing Standards No. 39 defines audit sampling as "the application of an audit procedure to less than 100 percent of the items within an account balance or class of transactions for the purpose of evaluating some characteristic of the balance or class" [SAS 39, ¶1]. A fundamental assumption underlying audit sampling is that items in the population are, for sampling purposes, homogeneous in the sense that observation of some subset of items is useful for drawing conclusions about the remainder of the population. This assumption is essential for inferences based on samples; without it, a sample cannot provide anything more than a description of part of the population. Further, this assumption is necessary for both statistical and judgmental sampling in auditing.

Whether statistical or judgmental sam-

Financial support for this research was provided by the Accounting Development Fund and the Graduate School of Business Research Fund at the University of Washington. The cooperation of the auditing firms that participated in our study is greatly appreciated. We would like to acknowledge the useful comments provided by Bill Felix, Bill Kinney, and Bill Waller and participants in the Accounting Workshop at Manchester University.

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pling is used to draw inferences about audit populations, it is important that we understand the basis for auditors' inferences. The basis for statistical inference in theoretical models seems well-defined, but the assumptions of the models do not always coincide with the conditions encountered in auditing. In particular, while theoretical models assume that population error amounts are assessed based on observation of a set of indistinguishable errors, in practice each of the dollar errors observed in a given sample is in some way unique; that is, the qualitative aspects of errors may vary.

Exactly how qualitative information is to be taken into account in the inference process is only vaguely understood. SAS No. 39 states that

> consideration should be given to the qualitative aspects of the errors. These include (a) the nature and cause of misstatements, such as whether they are differences in principle or in application, are errors or irregularities, or are due to misunderstanding of instructions or to carelessness, and (b) the possible relationship of the misstatements to other phases of the audit [SAS No. 39, ¶27].

However, beyond the ubiquitous admonition that auditors should exercise "professional judgment," there is little specific guidance for the practicing auditor on how qualitative aspects should affect inferences and decisions.[1]

Discussion with practicing auditors indicates that consideration of qualitative aspects of errors may lead auditors to treat *qualitatively* different errors in *quantitatively* different ways. In particular, qualitative considerations may lead auditors to "isolate" some sample items found to be in error where "isolated" items are not projected to the population. This practice may lead auditors to systematically underestimate population error and result in an excessive probability of incorrect acceptance.

In this study, we consider first the practice of "isolating" errors in the context of an abstract model of inference and discuss the relationship of the model to auditing. Next we review descriptive theories of human information processing which are relevant to the practice of isolating errors. Finally, we report the results of a survey which provides descriptive evidence on how qualitative aspects of errors influence the tendency of auditors to isolate errors in cases which deal with inferences about the dollar amount of error in an accounting population.

NORMATIVE AND DESCRIPTIVE THEORIES OF ERROR ISOLATION

We begin this section by analyzing the practice of isolating errors in a simple abstract model using balls and urns. Next, related descriptive research is briefly reviewed. Finally, the model and previous research are used to develop factors which are likely to affect an auditor's decision to isolate errors.

A Normative Model with Isolation of Errors

Consider an auditor using sampling to draw inferences about the population being sampled. Assume the auditor's problem is to use a sample of colored balls from an urn to draw inferences about the population of all balls in the urn. Specifically, assume the auditor is to construct the maximum likelihood estimate of the numbers of colored balls in the urn.[2]

---

[1] Few researchers have considered qualitative aspects of errors. An exception is Ferris and Tennant [1984]. They find that auditors place less reliance on internal control systems if they detect *intentional* errors.

[2] Although auditors often are also concerned with confidence limits or bounds, the maximum likelihood estimate is more intuitive and will serve to illustrate the main points. The extension to the common auditing problem of forming confidence bounds is straightforward.

Suppose the auditor is presented with the following situation. There is an urn which contains a total of N balls. An unknown number, say R, of the N balls are red and the remaining $(N-R)$ balls are assumed to be black. The auditor's problem is to estimate, based on a sample drawn with replacement, the number of balls in the population which are black (corresponding to error-free items in an audit setting) or equivalently, the number of balls in the population which are red (corresponding to items with errors).

The number of red items in a sample of size n drawn with replacement from this population has a binomial distribution with parameters R/N and n. The maximum likelihood estimate of the population proportion of red balls, R/N, is the sample proportion r/n. Thus, the maximum likelihood estimate of R is $N \cdot r/n$, i.e., the population size times the sample proportion.

Suppose the auditor draws, with replacement, a sample of size n and observes the following: Of the n items drawn, r balls are red, $(n-r-1)$ are black, and one item is red but is shaped like a cube rather than a sphere! That is, one of the sample items is qualitatively different from the others. The original statement of the problem is obviously incomplete and the auditor must formulate an inference which fits the situation revealed by the observations, rather than the problem as originally conceived. There are (at least) two approaches which might be adopted.

The first approach is to redefine the parameter which is being estimated to be the number of red *items* in the population (rather than the number of red balls). Then the sample proportion of red items can be used to estimate a *parameter*, the number of red items in the population, as:

Estimated red items in population $=N \cdot (r+1)/n$.

Equivalently, the estimated number of black items in the population is $N \cdot (n-r-1)/n$. Intuitively, this approach treats the red cube the same as a red ball, i.e., any red item (in auditing, any item with an error) has the same effect on inferences to the population. Thus, the red cube is assumed to provide information only about the *parameters* of the original problem.

The second approach uses the observed red cube to reformulate the *structure* of the problem as follows: Of the N items in the urn, one is now known to be a red cube; an unknown number, R, are assumed to be red balls; and the remaining $N-R-1$ balls are assumed to be black. Thus, the population in which R is unknown is now assumed of size $N-1$ and the sample proportion of red balls is $r/(n-1)$. Therefore, the maximum likelihood estimate of the number of red balls in the population is $((N-1) \cdot r/(n-1))$ and the estimate of the total number of red items is $1+((N-1) \cdot r/(n-1))$. Equivalently, the estimated number of black balls is $(N-1) \cdot (n-r-1)/(n-1)$. Intuitively, this approach treats the red cube as new information about the *structure* of the problem. The red cube is implicitly assumed to be unique; there are assumed to be no other cubes in the population. Thus, although the observation of the red cube has a minor effect on the estimates of the number of red (and black) balls in the population, it is not taken as an indication that other red items might be in the urn. Instead, the red cube is "isolated" and inferences are based only on the balls in the sample.

Which of these approaches is correct? In the abstract world of balls and urns, the answer depends on the "correct" view of the population, i.e., on the state of the world. If the red cube is unique, then the structural interpretation is more appropriate. If there is exactly one red cube in the urn, the sample does not reveal anything about other cubes in the urn but only reveals something about the remaining $N-1$ items, composed of an unknown mixture of red and black balls. On the other hand, if there may be other red cubes in the urn (or red cones or red discs or any red items other than balls), then the parameter interpretation is more appropriate since the observation of a red item forms the basis for inference about other red items which may exist in the population.

In auditing, there is a close parallel to the abstract ball and urn problem. It is not uncommon for an auditor to discover errors which he is ready to assume do not exist elsewhere in the population (i.e., errors which correspond to red cubes). Under the structural approach to unique errors, the auditor "isolates" unique errors rather than projecting them to the population. The difficulty with this approach in auditing is that auditors are seldom faced with situations where it is reasonable to rule out the possibility that a population contains other unique red shapes (e.g., cones, discs, etc.). In auditing, no two errors are truly identical; each error is associated with *some* unique characteristic. Therefore, the logical conclusion following from the position that unique errors should be isolated is that all errors should be isolated. However, if all errors are isolated, samples are useless for drawing inferences about populations. Thus, if an auditor maintains that sampling is useful for inferences about populations, it seems inconsistent to maintain simultaneously that unique errors should not be projected to the population.

Sometimes the isolation of an error is rationalized not on the basis of its unique characteristics *per se*, but because the auditor obtains additional evidence about all items in the population with similar characteristics. Consider an auditor who anticipates that the urn he is sampling may indeed contain cubes in addition to spheres. After discovering a red cube in a sample drawn from the urn he proceeds to search the urn for cubes and checks all cubes to determine the number of red cubes. He would then isolate these errors (cubes which are red) and not use the information in making inferences about the remainder of items (spheres) in the urn.

The potential fallacy of isolation of errors based on additional audit evidence can be seen by extending the previous example. Suppose each of the n sample items can be categorized as a member of a particular class of objects, e.g., one item is a sphere, another is a cube, another is a cone, etc. Further suppose that the population proportion of red items within each class of objects (and for the population as a whole) is M percent and that this percentage constitutes an unacceptable (material) proportion of red items. Thus, the correct conclusion for the auditor is that the population contains an unacceptably high proportion of red items.

Suppose the auditor observes r red items in the sample of n items and decides to examine all items in the classes of objects which correspond to the r red items. The auditor finds that the error rate in these classes is M percent. However, if the auditor now isolates all the discovered errors, he concludes that the error rate in the classes corresponding to the remaining $(n-r)$ sample items is zero. Therefore, the estimated population proportion of red items is $[M\% \times p] + [0\% \times (1-p)]$, where p is the proportion of the population composed of items in the classes corresponding to the r red items in the sample. Assuming p is less than one (i.e., assuming not all items in the population were examined), the auditor incorrectly concludes that the overall error rate in the population is less than M percent.[3,4]

---

[3] This problem is not simply an artifact of the assumption of equal proportions of red items in each class of objects, since cases could be constructed under other assumptions which also illustrate this point. For

Descriptive Research Related to Isolation of Errors

An interesting empirical question concerns which of the approaches is taken by practicing auditors. If the parameter approach is taken, seemingly unique errors will be projected. On the other hand, if the structural approach is taken, then "unique" errors (i.e., red cubes) will be isolated in projecting sample errors to audit populations. Isolation of errors by practicing auditors would be expected to lead to inferences which systematically misstate the amount of error in accounting populations.

Research in cognitive psychology suggests that auditors may be more likely to use the structural approach when "unique" errors are discovered. One of the most pervasive aspects of human thought is the use of categories [Glass, Holyoak and Santa, 1979]. The ability to organize items into categories facilitates learning, recall and communication. An interesting feature of most categories is that all items contained in a category do not have completely identical attributes. However, individuals often abstract information about the central tendency of items contained in a category and this abstraction is referred to as a prototype [Glass, Holyoak and Santa, 1979]. Membership in a particular category is often assessed in terms of an item's *similarity* to the prototype (referred to as prototype matching).

An example of prototype matching is provided by Rips [1975]. In this work subjects were presented with a story about an island that contained several species of mammals. One of the species was noted to have an unknown disease and subjects were asked to estimate the proportion of other species that had the disease. Subjects estimated higher proportions if the diseased species was a typical mammal (e.g., a horse) than if it was an atypical mammal (e.g., a mouse). In other words, subjects matched the diseased species to a prototypical mammal. To the extent that the diseased species and the prototype were assessed as similar, the disease was assumed to be widespread in the population.

The use of the representativeness heuristic [Kahneman and Tversky, 1972] is another example of a prototype matching approach. This heuristic allows individuals to reduce many inferential tasks to what are essentially simple similarity judgments. The strategy involves a similarity comparison between a sample observation and a population. If a sample item is assessed as similar to a population in essential characteristics, then the probability that the sample item was drawn from the population is considered to be quite high. An object is assigned to one conceptual category rather than to another according to the extent to which its principal features represent or resemble one category more than another [Nisbett and Ross, 1980].

The link between the work reviewed above and auditors' judgment of unique errors may be illustrated best with an example. Suppose an auditor is evaluating a sample of customer accounts and finds an

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example, suppose the proportion of red items in each class is either zero or 100 percent, i.e., the objects in each class are either all red or all black. Under this assumption, isolation of discovered errors is again inappropriate (unless the sample is known to contain at least one item from each class) because the observed items form the basis for inference about the unobserved classes. Isolation of errors would lead the auditor to conclude that the population error is equal to the number of objects in the classes of red items which happened to be chosen for the sample.

[4] It should also be noted that this problem is not due to stratification *per se*, but rather the fact that the stratification of the population is conditional on observed errors. Thus, for example, the auditor might properly decide *ex ante* that all cubes in the population should be examined and then use sample evidence to draw inferences about the remainder of the population. However, if the auditor decides to examine all cubes *because* an error was observed in some cubes and then isolates the sample evidence about cubes, incorrect inferences will be drawn.

error resulting from a temporary clerical employee misfooting an invoice. Although normal procedures call for clerks to foot invoices twice to ensure accuracy, the temporary employee did not follow procedures. A 100 percent examination of the invoices prepared by the temporary worker turns up two additional errors which are corrected. Further observation and discussion with client personnel indicates that other employees always check footings of invoices. Thus, the auditor has determined that it is very unlikely that similar undiscovered errors exist.

We expect auditors to make a similarity comparison between a discovered error and the psychological category of other potential errors in the population. When the discovered error appears to be relatively dissimilar to other errors in the category, auditors, like the subjects in Rips' [1975] study, may not consider the observation as indicative of errors in the population. Therefore, the auditor may consider projection of the error unwarranted and "isolate" the error.

Other Factors Related to Error Isolation in Auditing

Previous research suggests that the frequency of error isolation may be determined by similarity perceptions. However, empirically the frequency of error isolation might also be a function of individual-specific variables such as accounting firm membership, experience, and background in statistics. These factors are briefly discussed below.

Firm Membership. Based on an examination of the procedure manuals of 12 of the 14 largest U.S. auditing firms, Cushing and Loebbecke [1983] concluded that there are significant differences in firms' approaches to the audit process. Research conducted by Niles [1984] indicates that the judgment processes of auditors (measured on a systematic, directed continuum) are related to firm membership. Nanni [1984] demonstrated that differences in evaluations of internal control systems were related to firm differences. In light of these findings, it is possible that the tendency to isolate errors is also related to firm membership.

Experience. Experience effects have been documented in studies of auditor judgment (e.g., Messier [1983] and Nanni [1984]); hence, the experience of auditors may also affect their tendency toward isolating errors. For example, auditors with many years of experience may have observed many instances of "unique" errors. Repeated exposure may make such errors appear less unusual and decrease the tendency of experienced auditors to isolate unusual errors.

Training in Statistics. Auditors' training in statistics may also influence their tendency toward isolation. Auditors with an extensive background in audit sampling may be less likely to concentrate on qualitative aspects of errors and concentrate instead on applying the quantitative methods of evaluation. Also, auditors with more extensive training may be more reluctant to revise the structure of their statistical model.

RESEARCH METHOD

Practicing auditors were asked to assume the role of an auditor performing accounts receivable confirmations as of year-end and to evaluate seven hypothetical cases dealing with sample information in a variables sampling context. A single set of background information was used for all seven cases to allow the subjects to complete the materials in a short period of time. Subjects were asked to consider each error independently, i.e., to act as if each error or case was from a separate audit.

Each case presents a situation which might be encountered by a practicing auditor. The cases were developed through an iterative process of discussions and pretesting with academics and auditors. Subjects in the pretests were asked to comment on whether the cases were interesting and realistic. As a result of the pretesting, some cases were eliminated and changes were made to clarify the remaining cases and questions. Unfortunately, pretesting did not completely eliminate misunderstandings and ambiguity. Subjects' explanations of their responses to one case distributed with the questionnaire revealed that many subjects misinterpreted the case.[5] Since the case was ambiguous, it was eliminated from the analysis, leaving the seven cases discussed and analyzed in the paper.

The subjects were asked to assume that, based on preliminary estimates, they had decided to examine a random sample of 150 receivables from a population of 3,000 accounts and that the most likely population error can be estimated by multiplying the total sample error by 20 (i.e., 3,000 ÷ 150). The subjects were also asked to assume that if the error was projected to the population by multiplying by 20, the estimated error (in conjunction with other sample errors and allowing for sampling risk) would exceed tolerable error. Thus, the decision to project the error had nontrivial consequences. In each case, subjects were asked to decide whether to project the error described in the case and to briefly explain their decision.

Cases

The final versions of the seven cases are presented in Table 1. Cases 1, 2, and 4 were cases with unusual circumstances surrounding the error. Case 1 represents a deliberate error committed by a temporary employee. Since the auditor determines that there are no additional errors on invoices where the employee has motivation to commit additional errors, we expect auditors to recommend that the error not be projected. Cases 2 and 4 relate to errors in recording unique transactions. In Case 2, unearned interest is incorrectly recorded as sales revenue but the auditor determines that this was the only sale which involved interest. In Case 4, a consignment sale is recorded as a regular sale but the auditor determines that this was the only consignment sale during the year. Again, we expect auditors to isolate these errors because the error is unique.

Auditors may also isolate errors whose cause is not necessarily unique but can be determined to be unique by the application of audit procedures. Case 3 presents this type of situation. In this case, there is a misfooting related to a credit memorandum. While such misfootings may be quite common, the auditor has examined *all* credit memoranda and determined that no others contain footing errors. Thus, we expect auditors to conclude that the error should be isolated because they are certain that there are no identical errors in the population.

Case 5 represents a fairly common error that we expect auditors to project. Thus, Case 5 serves as a benchmark to be compared to the auditors' analyses of Cases 1 through 4.

Cases 6 and 7 are situations where it is unclear whether the "errors" fit the usual profile of an error. Case 6 is not really an error since the accounts receivable control account is not misstated and we expect auditors not to project the error. Case 7 is an error which the auditor would not have uncovered if the original sampling plan had been followed. However, since the error was detected in a "random" manner, we expect auditors to project the error to the population. In Cases 6 and 7 we are not interested in the relationship between

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[5] The case involved an error which was discovered and corrected by the client in the course of procedures not normally performed. Some subjects interpreted the case as if the error were detected by the system of internal control.

TABLE 1

CASES ANALYZED BY SUBJECTS

Case One

Account No. 841 was understated by $1,945.85. Nonetheless, the customer confirmed the proper balance. It was determined that a temporary clerical employee, who was related to a senior employee of the client's customer, deliberately misfooted sales invoices for the account and forged the initials of her superior who reviews all invoices for accuracy. The auditor has examined all invoices processed by the temporary clerical employee for the customer under consideration and found no additional errors. Also, the auditor examined an additional sample of invoices for other customers processed by the temporary clerical employee and found no additional errors.

Case Two

Account No. 2947 was overstated by $1,865.00. During December, the client agreed to sell $24,867.00 in merchandise to this customer with payment due in six months and 15% interest. An accounting clerk recorded the sale including unearned interest in the selling price, overstating sales and receivables. Discussion with client personnel indicated that all other sales were at the normal terms of *payment due on delivery* and did not include interest charges. A special exception was made for this customer to obtain his business.

Numerous tests of sales transactions were conducted by the auditor throughout the year. No sales arrangements including terms other than *payment due on delivery* were noted.

Case Three

Account No. 593 was overstated by $1,687.37 due to an error on a credit memorandum. The client apparently misfooted the invoices related to the credit by $1,687.37. In total, only 85 credit memos were issued during the year. To evaluate the extent of the error uncovered, the auditor examined all credit memos and checked the amounts by footing the totals on supporting documents. No additional footing errors were noted.

Case Four

Account No. 7685 was overstated by $1,095.00. A 15-year-old fork-lift truck had been shipped on consignment to a dealer in used equipment but, due to a misunderstanding, recorded as a sale using the expected selling price. Discussion with client personnel indicated that no additional consignment sales had been made and examination of equipment records indicated that no other items were retired during the past year.

Case Five

Account No. 8227 was overstated by $1,456.72 due to a pricing error. The client apparently charged the price for an item located just below the correct item in the price book. The error was not detected by the normal review of invoice accuracy.

Case Six

Account No. 2849 was overstated by $1,215.87 due to a sale being posted to this account when the sale should have been (but was not) posted to Account No. 2894. Examination of the sales invoice and shipping document indicated the amount represented a valid sale.

Case Seven

Account No. 1029 was overstated by $1,625.30. In referring back to the sampling plan, the auditor discovered that due to his own error (in relating random numbers to sample account numbers), Account No. 1029 had mistakenly been confirmed instead of Account No. 1092. He promptly mailed a confirmation for Account No. 1092 and the confirmation was returned without exception.

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similarity judgments and auditors' projection/isolation decisions. Rather, we are primarily interested in inter-auditor agreement on the appropriate disposition of these ambiguous items.

Table 2 summarizes our expectations as to which errors *will be* projected and our evaluation of which errors *should be* projected. From a normative standpoint, all of the errors should be projected except for Case 6, which does not represent an error that affects the financial statements. From a descriptive standpoint, we expect that auditors will choose not to project

TABLE 2
SUMMARY OF EXPECTATIONS

	Should Project?	*Will Project?*
Case 1	Yes	No
Case 2	Yes	No
Case 3	Yes	No
Case 4	Yes	No
Case 5	Yes	Yes
Case 6	No	No
Case 7	Yes	Yes

the errors associated with Cases 1 through 4. These cases either present unique circumstances or the auditor has been able to assure himself through additional audit work that identical errors do not exist in the population. As indicated in the table, however, our normative statement is that each of these errors should be projected. While the auditor may be sure that there are no *identical* errors in the populations, there may be *other unique* errors; that is, different errors which are also unique. Returning to our ball and urn analogy, an auditor can seldom reasonably conclude after observing a red *cube* that there are no other "unique" shapes since a variety of unique errors potentially exist in almost all accounting populations.

Subjects

Four offices of "Big Eight" auditing firms were selected to participate in the study. Each firm was provided questionnaires which they distributed and collected. They were instructed to distribute the materials to audit staff members at all levels. Selection of participants was not random and was left up to the discretion of each firm. Subjects were able to complete the questionnaire at their convenience and were provided with return envelopes which could be sealed. Thus, although the questionnaires were collected by the firm, the subjects were assured of anonymity.

Approximately 150 questionnaires were distributed, of which 109 were completed and returned. Table 3 provides demographic information on participants. As indicated in the table, participants came from all firm levels.

RESULTS

Since each subject responded to eight cases (though one was ultimately eliminated from the analyses), it is important to consider possible order effects. To control for order effects, we presented the cases in eight different orders, corresponding to the eight rows of a randomly selected 8×8 Latin square. Thus, each case appeared in each of eight possible positions in one of the eight orderings. To test for order effects, we conducted eight Kruskal-Wallis nonparametric tests with the eight orderings serving as independent variables and the responses to the cases serving as the eight dichotomous dependent variables. Only one of the eight analyses was significant at the ten percent level, which is not significantly different from the expected number of significant analyses under the null hypothesis that there are no order effects. Further, we were unable to discern any pattern of responses in the one significant analysis. In fact, the first presentation of the case and the eighth presentation of the case had almost identical frequencies of error projection. Thus, the experimental design and the results of

TABLE 3

DEMOGRAPHIC INFORMATION

Firm	*Number of Participants*
1	63
2	6
3	13
4	24
Unidentified*	3
	109

Position	*Number*
Staff	33
In-Charge	41
Manager	17
Partner	10
Unidentified**	8
	109

Minimum years experience—1
Maximum years experience—25
Median years experience—3

* Three subjects mistakenly forwarded their questionnaires directly to us. For these individuals we are unable to identify firm membership.

** Subjects failed to identify their position on the questionnaire.

the Kruskal-Wallis tests provide substantial assurance that order effects do not affect the results.

For each case, subjects were asked to decide whether the error described should be projected and to briefly explain their response. Also, subjects rated Cases 1 through 5 in terms of how similar the cause of the error described was to the cause of other potential errors. Subjects' ratings were recorded on a seven-point scale (1 = "not at all similar"; 7 = "very similar"). Similarity ratings are not appropriate for Cases 6 and 7 because the item in Case 6 is not an error as far as the financial statements are concerned and, for Case 7, the cause of the error is not described.

To examine our belief that isolation of errors is a significant practical issue, we asked subjects to indicate how frequently they have observed error isolation in practice. Subjects responded on a seven-point scale ranging from one = "never" to seven = "frequently." The median response was five. Subjects were also asked to respond on a seven-point scale (ranging from one = "strongly disagree" to seven = "strongly agree") to the statement that sample errors should be isolated if similar errors do not exist in the population. The median response was six. These responses suggest that isolation of errors often occurs in practice and auditors generally believe that isolation is appropriate if similar errors do not exist in the population.

Subjects also rated the realism of the cases and their interest in the cases on sev-

TABLE 4

PROJECTION FREQUENCIES AND ANALYSES OF FACTORS ASSOCIATED WITH PROJECTION

Case Number	% Recommending Projection	% Recommending Isolation	Median Similarity Rating	Firm Membership	Experience	Background in Statistics
1	18	82	2	n.s.	n.s.	n.s.
2	16	84	2	.01	n.s.	n.s.
3	25	75	4	n.s.	n.s.	n.s.
4	17	83	2	.05	n.s.	n.s.
5	88	12	6	n.s.	n.s.	n.s.
6	32	68	N/A	n.s.	.04	n.s.
7	51	49	N/A	.05	.10	n.s.

en-point scales ranging from one = "not at all realistic" (interesting) to seven = "very realistic" (interesting). The median responses to both questions were five. Thus, it appears that subjects found the cases to be both realistic and interesting.

Similarity Perceptions and Projection

The basic results of the study are summarized in Table 4. A large majority of auditors recommended isolation for Cases 1 through 4 and projection for Case 5. There was substantial disagreement as to whether projection or isolation was appropriate for Cases 6 and 7. These results are discussed in more detail below.

Cases 1 Through 5

Recall that Cases 1, 2, and 4 involved unusual circumstances surrounding the error presented. In these cases more than 80 percent of the subjects recommended that the errors be isolated. The median similarity rating for each of these cases was two, indicating that subjects did not feel that the causes of the errors were similar to the causes of other potential errors.

Case 3 presented a common error but the auditor was able to determine that identical errors did not exist in the population. In this case, 75 percent of the subjects recommended that the error be isolated. The median similarity rating was four, indicating that the cause of the error was not considered to be unique.

Case 5 presented a common error for which 88 percent of the subjects recommended projection. The median similarity rating of six implies that subjects viewed the cause of the error to be highly similar to the cause of other errors. We were somewhat surprised that even 12 percent (13 of 109) respondents would recommend that this error not be projected. Therefore, we carefully read the explanations given by each of the 13 respondents who recommended that this error not be projected. Two of these had not given any explanation, while the remainder gave various explanations why the error is unusual and should be isolated. While none of the explanations provide a convincing justification for the decision, there is little evidence that respondents misunderstood the case or were simply making random decisions without developing a rationale.

The summary measures in Table 4 for Cases 1 through 5 suggest that an auditor who believes the cause of an error is not similar to the causes of other errors in the population is more likely to recommend that the error be isolated. As a statistical test of this conclusion, we compared the similarity ratings of auditors recommending isolation to those recommending projection for Cases 1 through 5 using Mann-

Whitney tests. Each test was significant ($p=.01$).

Based on past descriptive research, we hypothesized that auditors would recommend isolating errors that appeared unusual and errors for which the auditor can conclude, based on additional audit work, that no identical errors exist. The results are consistent with our hypothesis. However, when auditors isolate an error they ignore the assumption which underlies inference from samples. That is, by isolating an error, an auditor chooses to ignore selectively the assumption that sample observations are useful for inference about the remainder of the population.

Cases 6 and 7

In Cases 6 and 7, we were not interested in similarity judgments but rather in the consistency of auditors' professional judgments. While we were unable to formulate a formal hypothesis which specified a level of agreement, there was less consistency than we expected. In Case 6, 32 percent of the subjects recommended projection when, in fact, the error presented had no effect on the balance of receivables. Thus, for purposes of estimating the population error, it was not even a sample error. In Case 7, 49 percent of the subjects recommended isolating the error. While it is true that the error would not have been observed if the auditor followed the original sample plan, it was uncovered in a random fashion and should be projected.

Since, contrary to our expectations, a substantial percentage of subjects recommended inappropriate treatment of sample errors in Cases 6 and 7, we examined subjects' explanations in detail to ensure that subjects understood the cases and carefully considered their responses. Our examination uncovered two responses for Case 6 and four responses for Case 7 which indicated a potential misunderstanding. However, elimination of these observations from the analysis does not change the conclusions presented.

Firm Membership, Experience, and Background in Statistics

The results in Table 4 suggest that isolation of errors is common among practicing auditors. In this section, we examine whether the tendency to isolate errors is related to firm membership, years of experience, or background in statistics. Further analysis of these factors is of interest for two reasons. First, these factors have been important determinants of auditor decisions in previous studies. Second, the implications of the results depend on the role of these factors. If, for example, we find that only inexperienced auditors tend to isolate errors, then isolation of errors would seem to be a problem which is naturally corrected by the process of acquiring further experience. Similarly, if isolation of errors is only common in one firm, then isolation of errors would be a problem to be addressed by that firm. However, if the analysis shows that isolation of error is more pervasive, then this practice is of general concern.

Firm Membership. To test for a firm effect, we conducted Kruskal-Wallis tests with the four firms serving as independent variables and the dichotomous projection/isolation decisions (coded one and two) serving as the dependent variables. A significance level of .10 is used since we consider this aspect of our study to be exploratory. Significant firm effects were noted for Cases 2, 4, and 7. Thus for some of the cases, there are significant differences related to firm membership.

To determine which firms are significantly different from one another, we analyzed all possible pair-wise comparisons using Mann-Whitney tests.[6] Detailed re-

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[6] An alternative method is Dunn's multiple comparison procedure [Hollander and Wolfe, 1973]. However, this method is quite conservative and may fail

TABLE 5
FIRM MEMBERSHIP EFFECTS

		Case 2		Case 4		Case 7	
Firm	*N*	*% Project*	*% Isolate*	*% Project*	*% Isolate*	*% Project*	*% Isolate*
1	63	6%	94%	10%	90%	51%	49%
2	6	17%	83%	33%	67%	100%	0%
3	13	38%	62%	38%	62%	31%	69%
4	24	29%	71%	21%	79%	54%	46%
		Significant differences:		*Significant differences:*		*Significant differences:*	
		1-3 ($p=.01$) 1-4 ($p=.01$)		1-2 ($p=.08$) 1-3 ($p=.01$)		1-2 ($p=.02$) 2-3 ($p=.01$) 2-4 ($p=.04$)	

sponses by firm are presented in Table 5 for these cases. For Case 2, there are significant differences between firm 1 and firms 3 and 4. For Case 4, there are significant differences between firm 1 and firms 2 and 3. For both these cases, we anticipated that similarity assessment would lead auditors to recommend isolation. Members of firm 1 were much more likely to isolate errors (more than 90 percent of firm 1 respondents recommended isolation), but large percentages of members of other firms (ranging from 62 percent to 83 percent) also recommended isolation.

In Case 7, significant differences between firms 1 and 2, 2 and 3, and 2 and 4 were detected. Apparently, different firms differ considerably in how they would treat an error uncovered by an auditor not correctly following a sample plan. At the extremes, none of firm 2 members recommended isolation while 69 percent of firm 3 members recommended isolation.

The significant firm effects are likely due to differences in the training by each firm. For example, it is possible that one (or more) of the firms uses training materials which include examples like one (or more) of the cases used in this study. However, we did not identify any propensity for subjects from one firm to project uniformly more or less frequently than subjects from other firms.[7] In summary, the practice of isolating errors seems to be common among all four firms included in our study.

Experience. To analyze the effects of experience, we categorized subjects according to their years of experience in auditing. Auditors with three or less years experience are included in group 1; four to six years, group 2; and seven or more years, group 3.[8] To test for an experience effect, we conducted Kruskal-Wallis tests

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to detect differences at traditional significance levels even though a Kruskal-Wallis procedure has indicated significant results exist.

[7] Cushing and Loebbecke [1983] and Kinney [1985] have classified CPA firms in terms of their audit approaches. We considered our firm membership results in terms of their categories. However, this did not provide us with any additional insight since there were significant differences between firms in the same category as well as significant differences between firms in different categories.

[8] A similar analysis was performed using the auditors' position in the firm as a measure of experience. The results using this approach are consistent with results we report in the paper.

TABLE 6

EXPERIENCE EFFECTS

Experience Level	Case 6			Case 7		
	N	*% Project*	*% Isolate*	*N*	*% Project*	*% Isolate*
1	67	40%	60%	67	52%	48%
2	23	22%	78%	21	33%	67%
3	17	12%	88%	16	69%	31%
		Significant difference: 1-3 ($p=.03$)			*Significant difference:* 2-3 ($p=.04$)	

with the three groups serving as independent variables and the dichotomous projection/isolation decisions serving as dependent variables. The results are presented in Table 4. As indicated, experience effects were observed in Cases 6 and 7. A detailed breakdown is presented in Table 6. Mann-Whitney tests revealed significant differences between groups 1 and 3 in Case 6 and between groups 2 and 3 in Case 7.

Recall that our normative conclusion was that the error should be isolated in Case 6 and projected in Case 7. In Case 6, more experienced auditors are more likely to isolate errors, and in Case 7, they are more likely to project errors. Thus, more experienced auditors are more likely to conform to our normative conclusion for Cases 6 and 7. For other cases, however, there were no significant differences in the tendency to isolate errors.

Background in Statistics. Since subjects may receive training in statistics from a variety of sources and quality of instruction cannot be controlled, we measured subjects' background in statistics by their self-assessments. In response to the question on background in statistics, 13 percent of the subjects rated their background as weak, 62 percent as adequate, 23 percent as good and two percent as excellent. Kruskal-Wallis tests were conducted with the projection/isolation decisions as the dependent variable and self-ratings serving as independent variables. As indicated in Table 4, none of the tests were significant at the .10 level. Thus, background in statistics as measured in this study is not a significant factor in determining the tendency to isolate errors.

SUMMARY AND CONCLUSION

Discussion with auditors and previous descriptive research suggest that auditors may be inclined to isolate "unique" or unusual sample errors. However, analysis of this practice suggests that isolation of errors is seldom justified in auditing. Nonetheless, we found that a large majority of auditors favored isolating errors that appeared to be unique.

The results suggest that members of certain firms are more likely to isolate errors and that additional experience reduces judgment errors related to error projection for certain errors. However, the observed differences do not represent radical differences between firms (such as one firm's members consistently recommending isolation with another firm's members consistently recommending projection). Rather, the differences varied by case, and we were unable to explain them in terms of available firm taxonomies. Similarly, the results indicate that the most experienced auditors (those with seven or more years of experience) are more likely to make correct decisions with respect to error projection for Cases 6 and 7. However, there were no differences related to experience for the cases dealing with "unique" errors, i.e., more experienced auditors are no less likely to incorrectly isolate "unique" errors.

Because inference from samples is a critical audit activity, it is reasonable to ask how auditors can survive and prosper if they incorrectly isolate "unique" sample errors. Several factors may mitigate the adverse consequences of this behavior. First, "unique" errors which are not projected by auditors may not occur often. If auditors experience relatively few situations which lead to judgmental errors, then the expected cost of the errors is not high and the relatively infrequent feedback is not likely to result in a change in auditor behavior. However, our discussions with practicing auditors suggest that "unique" errors like those presented in the cases are not uncommon. In fact, after reading an earlier version of this paper, one auditor commented that a rubber stamp marked "Isolated Error—Do Not Project" would have been a much used tool in his reviews of audit work papers.

A second, and more satisfactory, explanation is that failure to project a "unique" error is not often associated with a loss to the auditor. Incorrect acceptance of the hypothesis that an account is not materially misstated is not likely to happen often, simply because populations usually do not contain material errors. Moreover, auditors tend to overaudit, reducing the realized risk of incorrect acceptance. For example, analytical review risk is often set equal to 1.0 in audit planning even though analytical review is useful in detecting errors. Similarly, internal control risk is often set equal to 1.0 when, in fact, controls are at least partially effective. These practices make it relatively unlikely that an auditor will incorrectly accept the null hypothesis of no material misstatement. Finally, even if the auditor incorrectly accepts the hypothesis, the probability that the incorrect acceptance will subsequently be discovered and result in a loss to the auditor is probably substantially less than 1.0.

The analysis in this paper suggests that isolation of errors by auditors may lead to inappropriate inferences. The empirical results indicate that isolation of errors is relatively common. These findings are of concern to auditors relying on methods anywhere on the spectrum from the simplest methods of inference to the most elegant statistical models.

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Discriminating Between Reorganized and Liquidated Firms in Bankruptcy

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ABSTRACT: A model proposed by White [1981, 1984] for distinguishing bankrupt firms that successfully reorganize from those that liquidate is tested empirically in this study. Using probit analysis, two factors were found to have significant discriminating power: the proportion of assets not secured or pledged at the bankruptcy filing date (referred to as the free assets percentage) and the change in profitability in the years preceding bankruptcy. The probit model was able to classify accurately 69 percent of the firms in the estimation sample and 59 percent of the firms in a holdout sample.

Financial analysts, investors, bankruptcy courts, and others have recently been paying increased attention to the survival prospects and investment potential of companies involved in bankruptcy proceedings. Interest has been heightened by increases in the frequency, rate, and size of bankruptcies;[1] a few highly publicized corporate turnarounds;[2] the purported consistently superior market performance of certain investment funds and individual investors who specialize in bankrupt firms' securities;[3] relaxation of requirements under the new Bankruptcy Code for debtor firms to enter bankruptcy—Continental Airlines, Johns Manville, and Wilson Foods are examples of firms that have recently taken advantage of the modified provisions;[4] and favorable changes in the tax law governing bankrupt firms.[5]

Although many studies have documented the usefulness of financial accounting data and security price information in predicting bankruptcy (see Altman [1983] and Zavgren [1983] for reviews), little research has been conducted on the potential information value of these and other data in distinguishing between firms in

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[1] Dun and Bradstreet reports the following statistics on bankruptcy filings for commercial and industrial enterprises:*

	1975		*1983*	
Number	11,432		31,334	
Size ($Liabilities)	*Less than* $100,000	*Greater than* $100,000	*Less than* $100,000	*Greater than* $100,000
	7,504	3,928	15,972	15,362
Rate (per 10,000 firms)	43		110	

* Excludes finance, insurance, real estate companies, farmers, and professionals.

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bankruptcy that successfully reorganize versus those that ultimately fail and are forced to liquidate. This paucity of research may be attributed to the absence of a clear understanding among economists, finance theorists, and other researchers regarding the bankruptcy reorganization process [White, 1981], the not-well-known fact that as many as 30 percent of publicly-traded bankrupt firms successfully reorganize [Altman, 1983; LoPucki, 1983], and data availability and collection problems that are particularly acute for bankrupt firms [Ohlson, 1980].

The Brookings Report [Stanley and Girth, 1971] and the *Report of the Commission on the Bankruptcy Laws of the United States* [U.S. Congress, 1973] found little evidence that bankruptcy courts had systematically studied the survival prospects of firms petitioning for bankruptcy reorganization. According to LoPucki [1983], this same situation exists today. She presents empirical evidence that the success rate of firms entering bankruptcy reorganization since the new Bankruptcy Code became effective in October 1979 is even lower than it was ten years ago. LoPucki [1983, p. 113] suggests that to improve matters, "future researchers should . . . identify the characteristics of businesses which enable them to succeed in reorganization proceedings with sufficient precision to reliably predict which will do so." In a different context, Altman [1983, p. 242] provides evidence of attractive returns to both debt and equity holders of bankrupt companies and states succinctly that "the trick is to determine which firms are likely candidates for successful reorganization."[6]

The purpose of the present study is to examine empirically the predictive content of a model of the bankruptcy reorganization process proposed by White [1981, 1984]. The aim is to assess the importance of the variables suggested by White for distinguishing bankrupt firms that successfully reorganize and those that liquidate.

PRIOR RESEARCH

Two studies have empirically examined differences in the financial characteristics of liquidated and successfully reorganized firms.[7]

Hong [1983] developed a theoretical model to distinguish among three categories of financially distressed firms: firms that file for bankruptcy and then successfully reorganize, firms that file for bankruptcy but ultimately liquidate, and firms that continue operating without filing for bankruptcy. Hong posited that a firm's "intangible asset," i.e., the difference between the value of the firm as a going concern and its value in liquidation, would be the major explanatory factor affecting the eventual outcome. The larger

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[2] For example, Interstate Stores (now Toys 'R' Us), Penn Central, Equity Funding (now Orion Capital) and Daylin (acquired by W.R. Grace).

[3] See *Barron's* [1982] and *The New York Times* [1982, 1984]. Mutual Shares Corp., which specializes in bankrupt firms' securities, is ranked eighth out of over 600 mutual funds by Lipper Analytical Services for price appreciation over the last ten years.

[4] As explained by Yacos [1983], debtor firms no longer need to prove that they are insolvent. "All a company really needs [under the new Bankruptcy Code] in order to come into the reorganization court, is the filing fee and a petition saying that it wants relief. . . .".

[5] See Altman [1983, pp. 27–31] for a description of relevant changes contained in the Bankruptcy Tax Bill of 1980, effective 1981.

[6] The objective of this study is not inconsistent with the view that the securities markets for bankrupt firms are semi-strong efficient. Even in such markets, a model that increases the efficiency of information processing would have value. The primary beneficiaries of predictive models, however, may be the credit (loan) market and bankruptcy courts.

[7] A third empirical study, by Comerford [1976], is an unpublished Ph.D. dissertation. Due to unexplained inconsistencies in Comerford's results between two similar models tested and his inability to validate the results in an independent holdout sample, Comerford's study is not discussed more fully here.

the firm's intangible asset, the more likely that a firm has sustainable economic value that will permit it to survive rather than be liquidated. Hong also hypothesized that industrial classification, size, and the level of free (unsecured) assets would be significant independent variables.

Hong restricted the empirical analysis to firms that successfully reorganized and those that liquidated. Her sample consisted of 28 liquidated and 71 successfully reorganized firms that had filed bankruptcy petitions during the period 1970 to 1979. "Successes" were firms whose reorganization plans had been confirmed and "failures" were firms that had been adjudicated bankrupt (liquidated) by the courts.[8] She constructed three logit models, one each for the three most recent years' financial statements prior to the filing of the bankruptcy petition. For all three years the intangible asset and size variables were insignificant and, contrary to expectations, were negatively related to the probability of successful reorganization. The most important discriminatory variable was free assets, which was positively related to successful reorganization and was statistically significant in each year. Industrial classification was significant only in the second year. Hong's study was limited to testing hypotheses about the importance of individual variables, and therefore she did not analyze the classification accuracy of multivariate models.

LoPucki [1983] conducted an exploratory study of 41 firms that petitioned the Bankruptcy Court of the Western District of Missouri during the first year after the effective date (October 1, 1979) of the new Bankruptcy Code. "Successes" in this study were defined as firms having confirmed reorganization plans that continued to exist for approximately three years subsequent to the date of filing the bankruptcy petition. Failures were those firms that had ceased operating before February 1983.

LoPucki did not attempt to build a model with discriminatory power, but rather simply examined relationships between the outcome of the reorganization process and several individual variables. These included type, size, and age of the business, the existence of creditor opposition to the reorganization plan, and geographical location. The following relationships were found: manufacturing firms had a significantly higher success rate; larger firms were significantly more successful; age was not significantly related to success; successful firms were more often the target of creditor opposition; and geographical location was not a significant explanatory variable.

In summary, only a limited amount of empirical research has been conducted on the topic of discriminating between successes and failures in bankruptcy, and results have been inconclusive. The one published study [LoPucki, 1983] to date examined first-order correlations and did not attempt to build a classification model. The other study [Hong, 1983] examined the relative importance of individual variables and did not analyze the classification accuracy of a multivariate model. As discussed more fully below, the present study examines the classification accuracy of a multivariate model using data from both a prediction sample and a holdout sample of 113 firms.

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[8] Three significant dates are referred to frequently in this paper: the filing date, the confirmation date, and the date of bankruptcy adjudication. The filing date is the date on which formal bankruptcy reorganization proceedings commence. The confirmation date marks the approval of the bankrupt firm's plan of reorganization by the bankruptcy court. The date of bankruptcy adjudication is the date on which the bankruptcy court issues an order converting reorganization proceedings into liquidation proceedings. The amount of time between the filing date and either the confirmation date or the bankruptcy date varies across firms.

RESEARCH METHOD

Independent Variables

One criticism of previous research attempting to predict which firms will and will not initially file for bankruptcy is the lack of a well-accepted theory to guide the selection of independent variables [Ball and Foster, 1982]. A similar criticism can be made when studying bankrupt firms that successfully reorganize and those that liquidate. The choice of predictor variables in this study is motivated by a model of the outcome of bankruptcy proceedings proposed by White [1981; 1984]. White demonstrates analytically that, other things being equal, firms that successfully reorganize:

1. *Have more free assets.* Free assets, those not secured by previous borrowing, are available as collateral for additional borrowing. The larger the proportion of free assets, the greater the ability of the firm to obtain additional financing needed to emerge successfully from bankruptcy proceedings.
2. *Are larger.* The size variable is likewise related to borrowing capacity. Larger firms are more likely to have raised capital in the past by issuing long-term, unsecured bonds. The assets generated by such borrowing are available to serve as collateral for additional borrowing.
3. *Have more attractive earnings prospects.* Firms expected to operate profitably in the near future should be able to generate funds internally or obtain funds from external borrowing in order to emerge successfully from bankruptcy proceedings.
4. *Have strong equity commitments by management.* Owners' equity claims are generally eliminated in liquidation. As White [1982, 1983] points out, this fact provides managers acting as agents of the owners with a strong incentive to prefer reorganization to liquidation. The larger the potential loss to management, the greater the incentive to reorganize rather than liquidate.

The following measures were selected as operational proxies for the independent variables in White's model:

1. Free assets percentage = non-collateralized tangible assets divided by the total tangible assets as of the most recent financial statement date prior to filing for bankruptcy (free assets).
2. Total assets as of the most recent financial statement date prior to bankruptcy (size).
3. Change in total assets between three years prior to filing for bankruptcy and the date of the most recent financial statement prior to bankruptcy (change in size).
4. Net income divided by total assets for the most recent year prior to filing for bankruptcy (earnings prospects).
5. Retained earnings divided by total assets as of the most recent balance sheet date prior to bankruptcy (earnings prospects).
6. Stock option percentage = number of shares of common stock potentially issuable from outstanding stock options as a percentage of the number of outstanding shares of common stock as of the most recent financial statement date prior to bankruptcy (equity commitment by management).

The free assets measure focuses on the proportion of tangible assets that has not been collateralized. Lenders to firms experiencing financial difficulty are more likely to be interested in the tangible assets that could be attached in the case of liquidation than in intangible assets that have no severable market value. The free assets percentage was determined using data from the notes to the financial statements.

The size variable in White's model is measured in this study using both total assets just prior to bankruptcy and change in assets during the three years preceding bankruptcy. Because White links size to borrowing capacity, the use of assets rather than sales seemed a more reasonable base for capturing borrowing capacity. The direction and rate of change in total assets during the three years prior to bankruptcy provide lenders with information for predicting the likely change in assets in the near future and thereby the availability of assets to service any new borrowing.

The two earnings-based ratios were included as surrogates for the attractiveness of earnings prospects because earnings forecasts were not available. The return on assets for the most recent year prior to bankruptcy may be the best predictor of future profitability if earnings follow a random walk. The ratio of retained earnings to total assets attempts to capture changes in profitability during the years prior to bankruptcy. Firms that have experienced one or two years of extremely poor profitability relative to historical experience are likely to have low or even negative retained earnings. Such extreme operating difficulties may signal a low probability of successful exit from bankruptcy. On the other hand, firms that have had a few years of weak earnings performance may experience only minor deterioration of retained earnings and signal a higher probability of turning operations around. Previous bankruptcy prediction studies [Altman, 1983] have found the retained earnings percentage to be a significant discriminating factor between firms that do and do not initially file for bankruptcy. Firms that successfully exit bankruptcy may be hypothesized to have a retained earnings percentage more like firms that never enter bankruptcy than firms that are liquidated during bankruptcy proceedings.

The stock option percentage is admittedly a crude gauge of management's equity commitment. It would be desirable to know the proportion of management's wealth tied up in a firm, but it is not possible to ascertain this information for our sample firms.

Definition of Successful Reorganization and Liquidation

Figure 1 portrays certain events and dates relevant to the definition of successes and liquidators. A "success" is defined as a firm that filed for bankruptcy at point A, had a reorganization plan approved by creditors and confirmed by the bankruptcy court at point B, and continued in operation for at least three years subsequent to the confirmation date.[9] A "liquidation" is defined as a firm that filed for bankruptcy at point A and was either adjudicated bankrupt in bankruptcy court or voluntarily decided to cease operations and liquidate as of point C.

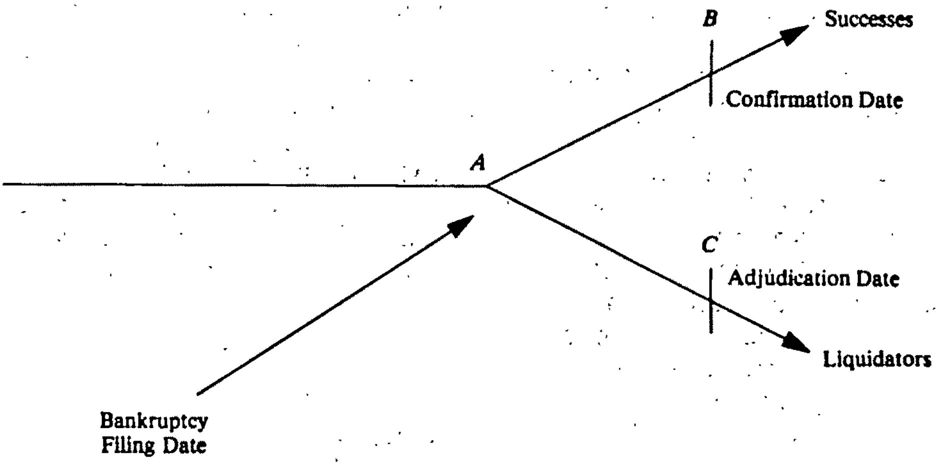
Sample Firms

The initial sample of firms studied con-

[9] Classifying a bankrupt firm as a "success" was problematic. One possible, but rather restrictive, definition would have been a firm that had its reorganization plan both confirmed and eventually consummated. Because the time between confirmation and eventual consummation can span many years, this definition of a success would have injected a bias against finding an association between the pre-bankruptcy financial data and the eventual outcome of the bankruptcy proceedings. It would also have significantly reduced the number of successes in the sample. On the other hand, if a "success" were defined as a firm that had its reorganization plan confirmed and that continued to operate for, say, one year after the confirmation date, we might have classified firms as successes when in fact those firms failed shortly after the one-year period. The three-year survival period after the confirmation was chosen as a compromise between these two potential sources of bias.

FIGURE 1

RELEVANT DATES IN DEFINING SUCCESSES AND LIQUIDATORS IN THIS STUDY



sisted of 57 successes and 61 liquidators. Various sources were used to build the sample. A list was assembled of firms mentioned under the heading "Bankruptcies" in the *Wall Street Journal Index* for the years 1970 through 1981. To be considered further, the following criteria had to be met:

1. Three years of audited financial statements were issued and available prior to the bankruptcy filing date; and
2. The confirmation date or adjudication date occurred within three years of the bankruptcy filing date.

The first criterion was imposed in order to be able to study the change in size for a reasonable number of periods prior to the bankruptcy filing date. For most firms, the three years of audited financial statements were for the most recent three annual accounting periods prior to the filing date. For some firms, however, the financial statements for the most recent year immediately preceding the filing date were not publicly available until after the filing date, if at all. As a consequence, the three years of financial statements for these firms were those for four, three, and two years prior to bankruptcy.[10]

The second criterion assured that an inordinate amount of time would not elapse between the date of the financial data set and the determination of critical success/failure dates of each company. As the elapsed time increases, it becomes less likely that the financial condition prior to bankruptcy will correlate significantly with the eventual status of these firms.[11]

The successes in this sample were identified by examining three consecutive years of Moody's *Industrial* and *OTC Manuals* after the confirmation date to establish that the company had continued to operate during that period. The liquidators were identified by consulting the *Directory of Obsolete Securities*. The financial statements were obtained from Disclosure, Inc. Standard and Poor's *Corporation Records* and Predicasts *F&S Index of Corporate Change* were consulted to cross-validate the accuracy of the data collected from the other sources.

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[10] This procedure admittedly affects the time comparability of financial statement data sets across firms (i.e., one year old for some firms and two years old for others). However, we consistently use the most recently available information prior to bankruptcy in all cases. This would be the information set available to an investor attempting to predict *as of the bankruptcy date* which firms are likely to survive and which are likely to liquidate.

[11] In building the initial sample of 118 firms, only three firms had to be eliminated for not satisfying this second criterion.

The six financial measures used as independent variables were then calculated for each firm, and summary statistics for all 118 firms computed. Two variables, total assets and change in total assets, were converted to their natural log form to reduce skewness. The skewness of Variable 5, retained earnings/total assets percentage, was intolerably large due to the presence of outliers—four firms that had negative retained earnings in an amount larger than total assets. The skewness of Variable 4, net income/total assets, was likewise intolerably large because of the presence of another outlier—one firm with a large negative ratio. These five firms were eliminated from the study.[12]

The remaining sample of 113 firms is large relative to sample sizes used in bankruptcy prediction studies, as well as the two studies reviewed earlier. These firms were ordered chronologically according to the month in which they filed for bankruptcy and the following subgroups were defined:

Group 1 Combined Group ($n=113$)
Liquidators = 57
Successes = 56
Group 2 1970–1975 Filing Date ($n=72$)
Liquidators = 37
Successes = 35
Group 3 1976–1981 Filing Date ($n=41$)
Liquidators = 20
Successes = 21

Table 1 presents summary statistics of the six independent variables for each of these three groups.

Analysis

The following analyses were then conducted on the data for the sample firms:

1. Using the Group 1 (combined) data, a probit analysis [Finney, 1964] was performed to see if there was an overall difference between the liquidators and the successes.[13]
2. Using the Group 2 (1970–1975 filers) data as the sample for analysis, probit analysis was used to develop a best-fitting equation. This probit function was then applied to the Group 3 (1976–1981 filers) data, which served as the holdout sample. The purpose of this analysis was to assess the predictive accuracy of the probit model to a holdout sample of firms filing for bankruptcy later than the firms in the prediction sample.[14]

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[12] The five firms were American Bioculture, Behavioral Research Laboratories, Career Academy, Open Road Industries, and Rosenau Brothers. It is of interest to note that the retained earnings/total assets percentage was a significant discriminating variable in our study, and four of the five firms eliminated are liquidators. If these firms had been permitted to remain in the sample, our results would have been strengthened (i.e., higher classification accuracies).

[13] The research method used in bankruptcy prediction studies has evolved over time from discriminant analysis to probit analysis. We used both analytical techniques in this study, in part to assess their relative power in capturing differences in the samples of liquidators and successes. The results from the two approaches were nearly identical, with the discriminant analysis yielding slightly higher classification accuracy. The results of the discrimination analysis are available from the authors upon request.

[14] It might have been of interest to divide the Group 3 holdout sample into two subsamples: firms filing for

TABLE 1

SUMMARY STATISTICS OF SAMPLE FIRMS

Group 1 Combined (n = 113)

*Independent Variable**	*Mean*	*Standard Deviation*	*Skewness*	*Minimum*	*Maximum*
1 ln(TA)	1.42	0.55	0.20	−0.35	3.03
2 ln(TA/TA′)	0.02	0.21	0.30	−0.58	0.65
3 NINC/TA	−0.14	0.17	−1.03	−0.61	0.16
4 RE/TA	−0.10	0.30	−1.19	−0.98	0.40
5 FA%	0.43	0.40	0.28	0.00	1.00
6 ST.OPT	0.04	0.03	1.39	0.00	0.20

Group 2 1970–1975 Filing Date (n = 72)

Independent Variable	*Mean*	*Standard Deviation*	*Skewness*	*Minimum*	*Maximum*
1 ln(TA)	1.37	0.55	−0.02	−0.35	3.03
2 ln(TA/TA′)	0.05	0.21	0.54	−0.37	0.65
3 NINC/TA	−0.13	0.16	−0.92	−0.61	0.16
4 RE/TA	−0.13	0.31	−1.11	−0.95	0.31
5 FA%	0.47	0.40	0.13	0.00	1.00
6 ST.OPT	0.04	0.03	1.47	0.00	0.20

Group 3 1976–1981 Filing Date (n = 41)

Independent Variable	*Mean*	*Standard Deviation*	*Skewness*	*Minimum*	*Maximum*
1 ln(TA)	1.51	0.55	0.60	0.54	2.94
2 ln(TA/TA′)	−0.04	0.19	−0.24	−0.58	0.37
3 NINC/TA	−0.14	0.17	−1.18	−0.60	0.05
4 RE/TA	−0.04	0.29	−1.40	−0.98	0.40
5 FA%	0.35	0.39	0.56	0.00	0.99
6 ST.OPT	0.03	0.03	0.77	0.00	0.12

* The independent variables are defined using the following:

TA = Total assets at most recent balance sheet prior to bankruptcy.
TA′ = Total assets at balance sheet three years prior to bankruptcy.
NINC = Net income.
RE = Retained earnings.
FA% = Free assets percentage.
ST.OPT = Stock option percentage.

3. Using the Group 2 (1970–1975 filers) data, the stability of the probit analysis procedure was examined using a sensitivity analysis. Five liquidators and five successes were randomly removed and a linear discriminant procedure [Cooley and Lohnes, 1971] applied to the remaining 62 firms. This process was repeated 20 times.

The objective was to determine if the combination of variables identi-

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bankruptcy before the change in the bankruptcy law in October 1979 and those filing after the change. Our Group 3 holdout sample, however, included only five firms that filed after the change in the law. With time, sufficient post-1979 cases will accumulate to be able to assess the prediction accuracy of our model in the new legal setting.

TABLE 2
PROBIT ANALYSES FOR GROUP 1

(a) Likelihood Ratio Test of the Null Hypothesis of Zero Slope Coefficients:

Chi-square value (with 6 d.f.) = 19.74 (prob. = .0032)

(b) Asymptotic t-Tests for the (Probit) Regression Coefficients:

	Coefficient	*t(106) values*	*1-tail Probs.*
ln(TA)	−0.0913	−0.3167	.3757
ln(TA/TA′)	−1.0416	−1.6427	.0502
NINC/TA	−0.0524	−0.0558	.4778
RE/TA	1.2503	1.9318	.0267
FA%	0.8949	2.5468	.0054
ST.OPT	0.6416	0.1529	.4392
Intercept	−0.1516	−0.2627	.3964

(c) Classification Analysis (Bayesian rule) of the Sample Data:

		Classified as		
		LIQ	*SUC*	
Actual	LIQ	41	16	57
	SUC	17	39	56
		58	55	113

Number of Correct Classifications = 80 (70.8%)

fied as significant for all 72 firms was stable, or repeatable, over numerous random subsamples.

4. Using the Group 3 (1976–1981 filers) data as the sample for analysis, probit analysis was performed to assess the relative significance of the six independent variables in discriminating between successes and liquidators during the 1976 to 1981 time period. As will soon be made clear, this last analysis was necessitated by the results obtained from using the Group 3 firms as a holdout sample.

RESULTS

Combined Group 1 Data

Table 2 presents the results of the probit analysis for all 113 sample firms. A chi-square test shows statistically significant overall discrimination between the liquidators and successes. In the presence of all six variables, three are identified as significant explanatory variables: the changes in total assets, the retained earnings/total assets percentage, and the free assets percentage. Using a simple Bayesian classification rate, the classification accuracy of the model is 70.8 percent.

Group 2 Data Used in Prediction of Group 3 (Holdout) Data

Table 3 presents the results using the Group 2 data as an estimation (or prediction) sample and applying the resulting probit function to the Group 3 (holdout) sample. The chi-square test of overall dis-

TABLE 3

PROBIT ANALYSIS USING GROUP 2 AS THE ESTIMATION SAMPLE AND GROUP 3 AS THE HOLDOUT SAMPLE

(a) Likelihood Ratio Test of the Null Hypothesis of Zero Slope Coefficients:

Chi-square value (with 6 d.f.) = 14.47 (prob. = .0247)

(b) Asymptotic t-Tests for the (Probit) Regression Coefficients:

	Coefficient	*t(65) values*	*1-tail Probs.*
ln(TA)	−0.1231	−0.3340	.3693
ln(TA/TA′)	0.3514	0.3899	.3499
NINC/TA	−1.2599	−1.0532	.1483
RE/TA	1.8392	1.9069	.0290
FA%	0.6634	1.3759	.0850
ST.OPT	1.4048	0.2892	.3852
Intercept	−0.2191	−0.2816	.3880

(c) Classification Analysis (Bayesian rule) for the Estimation Sample:

		Classified as		
		LIQ	*SUC*	
Actual	LIQ	26	11	37
	SUC	11	24	35
		37	35	72

Number of Correct Classifications = 50 (69.4%)

(d) Classification Analysis (Bayesian rule) for the Holdout Sample:

		Classified as		
		LIQ	*SUC*	
Actual	LIQ	12	8	20
	SUC	9	12	21
		21	20	41

Number of Correct Classifications = 24 (58.5%)

crimination for the Group 2 subsample was again statistically significant. As was the case for the Group 1 combined sample, the retained earnings/total assets and free assets percentages were the most significant explanatory variables. The change in total assets variable, however, drops out as a significant explanatory variable for Group 2. The classification accuracy of the model applied to the Group 2 data was 69.4 percent, very similar to that for the Group 1 (combined) sample discussed above. When the probit function derived from the Group 2 data is applied to the

Group 3 (holdout) data, the classification accuracy falls to 58.5 percent.[15] Although some decrease in classification accuracy is expected when using a holdout sample and although this accuracy is better than a model that predicts liquidators and successes randomly, the decrease in classification accuracy for Group 3 firms requires further examination.

Sensitivity Analysis Applied to Group 2 Data

One possible reason for the decrease in classification accuracy noted above is that the Group 2 data set contained subgroups of firms for which the retained earnings/total assets and free assets percentages were poor discriminators. That is, although the probit analysis identified the two variables that were significant explanatory variables for the 72 firms as a whole, there may have been considerable variability within this group of firms in the variables that best discriminated. To assess this possibility, a sensitivity analysis was conducted using the data for Group 2 firms. As indicated previously, five liquidators and five successes were randomly removed and a linear discriminant function derived for the remaining 62 firms. The independent variables identified as significant discriminators and the accuracy of the discriminant function in classifying both the 62 estimation sample firms and the ten holdout firms were studied. This procedure was repeated 20 times.

In all 20 independent trials, the only two variables that appeared as significant discriminators were the retained earnings/total assets and free assets percentages. The classification accuracy of the discriminant function when applied to the 62 estimation sample firms in each of the 20 trials is similar to that for the 72 Group 2 firms as a whole. Because of the small size of the holdout sample in this case (ten firms on each trial), one would expect considerable variation in classification accuracy. However, even for these small holdout samples, the classification accuracies fall in the 60 to 70 percent range for 17 out of 20 of the samples. Thus, the original probit function for the 72 Group 2 firms would appear to capture quite well the differentiating characteristics of the liquidators and successes in the 1970–1975 time period.

Group 3 Data Examined Independently

The remaining possible explanation for the decrease in classification accuracy is that the combination of variables discriminating between liquidators and successes in the 1976 to 1981 period was different than in the 1970 to 1975 period. To examine this possibility, probit analysis was run on the Group 3 (1976–1981 filers) data only. The results are presented in Table 4. The chi-square test for overall discrimination is again statistically significant. As was the case for Group 1 and Group 2 analyses, the free asset percentage continues to be a significant variable for the Group 3 data. However, the change in total assets and the net income/total assets variables now replace the retained earnings/total assets variable as the significant explanatory factors.

As a firm approaches bankruptcy, it usually operates unprofitably. This will cause a low, or even negative, ratio of net income/total assets and a decrease in both total assets and retained earnings. Unless the asset decrease can be restrained by borrowing, we would expect the weak profitability results and the change in total assets to be correlated with the retained earnings/total assets variable. If

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[15] The classification accuracies using discriminant analysis instead of probit analysis in this study (see footnote 13) were as follows: Group 1, 72.6 percent; Group 2 as estimation sample, 72.2 percent; Group 3 as holdout sample, 61.0 percent; Group 3 as estimation sample, 80.5 percent.

TABLE 4

PROBIT ANALYSES OF GROUP 3

(a) Likelihood Ratio Test of the Null Hypothesis of Zero Slope Coefficients:

Chi-square value (with 6 d.f.) = 21.50 (prob. = .0016)

(b) Asymptotic t-Tests for the (Probit) Regression Coefficients:

	Coefficient	*t(65) values*	*1-tail Probs.*
ln(TA)	−0.4335	−0.6358	.2681
ln(TA/TA′)	−7.0646	−2.2051	.0163
NINC/TA	5.7420	1.5759	.0602
RE/TA	0.1251	0.0864	.4646
FA%	2.2097	1.8636	.0339
ST.OPT	−4.2876	−0.3813	.3533
Intercept	0.6610	0.6348	.2684

(c) Classification Analysis (Bayesian rule) of the Sample Data:

		Classified as *LIQ*	*Classified as* *SUC*	
Actual	LIQ	15	5	20
	SUC	7	14	21
		22	19	41

Number of Correct Classifications = 29 (70.7%)

this is the case, then the substitution of the net income/total assets and the change in total assets variables for the retained earnings/total assets variable in the 1976–1981 period may simply be that the former measures more effectively capture declining profitability during the time period. Table 5 presents the first-order correlations among each of the six independent variables for Groups 1, 2, and 3. The correlation between net income/total assets and retained earnings/total assets is .42 in the 1970–1975 time period as compared to .63 in the 1976–1981 period. Likewise, the correlation between change in total assets and retained eanings/total assets in the 1970–1975 time period is .33 as compared to .52 in the 1976–1981 period. It would appear that all three variables are drawing heavily from similar underlying operating phenomena (i.e., declining profitability) and that net income/total assets and change in total assets better capture this factor in the 1976–1981 time period while retained earnings/total assets better capture this factor in the earlier time period.

DISCUSSION AND CONCLUSIONS

The results of this study provide strong support for the importance of two of the factors posited by White as distinguishing bankrupt firms that liquidate versus those that successfully reorganize. The free assets percentage was a significant discriminating variable for the 11-year period as a whole under study, as well as for the two

TABLE 5

CORRELATION MATRICES

Group 1 (n = 113)

	1	*2*	*3*	*4*	*5*	*6*
1 ln(TA)	1.00	0.14	0.18	0.37	0.16	−0.25
2 ln(TA/TA′)	0.14	1.00	0.40	0.35	0.12	0.08
3 NINC/TA	0.18	0.40	1.00	0.49	0.20	0.04
4 RE/TA	0.37	0.35	0.49	1.00	0.37	−0.07
5 FA%	0.16	0.12	0.20	0.37	1.00	−0.02
6 ST.OPT	−0.25	0.08	0.04	−0.07	−0.02	1.00

Group 2 (n = 72)

	1	*2*	*3*	*4*	*5*	*6*
1 ln(TA)	1.00	0.19	0.12	0.35	0.10	−0.31
2 ln(TA/TA′)	0.19	1.00	0.46	0.33	0.06	0.05
3 NINC/TA	0.12	0.45	1.00	0.42	0.19	0.02
4 RE/TA	0.35	0.33	0.42	1.00	0.38	−0.04
5 FA%	0.10	0.06	0.19	0.38	1.00	0.05
6 ST.OPT	−0.31	0.05	0.02	−0.04	0.05	1.00

Group 3 (n = 41)

	1	*2*	*3*	*4*	*5*	*6*
1 ln(TA)	1.00	0.13	0.29	0.37	0.33	−0.08
2 ln(TA/TA′)	0.13	1.00	0.35	0.52	0.16	0.04
3 NINC/TA	0.29	0.35	1.00	0.63	0.22	0.07
4 RE/TA	0.37	0.52	0.63	1.00	0.44	−0.09
5 FA%	0.33	0.16	0.22	0.44	1.00	−0.24
6 ST.OPT	−0.08	0.04	0.07	−0.09	−0.24	1.00

subperiods examined separately. Earnings prospects, to the extent that this factor can be captured by past profitability, also plays an important role. The particular financial statement ratios that best represented past profitability changed between the two subperiods studied for no apparent reason. However, the importance of past profitability as a discriminator was supported by the results of the study.

The other two factors posited by White, size and equity commitment by management, were not found to be significant discriminating factors, at least not in a multivariate setting. In the case of management equity commitment, the results may be due to the measure used (stock option percentage). As indicated earlier, it would be desirable to obtain some measure of management's relative wealth position that is at risk to adequately study this factor.

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Authoritarianism and Participative Budgeting: A Dyadic Analysis

Robert H. Chenhall

ABSTRACT: Authoritarianism has been the most widely studied personality variable in management accounting research. One important line of research has been the role of authoritarianism as a moderating variable in studies which examine the effectiveness of budgetary participation. Results from these studies have been equivocal. In this paper it is argued that the lack of consensus in this research may be a consequence of examining the personality of only one member of the group involved in the participative process, usually the subordinate. It is claimed that improved understanding of the influence of authoritarianism on subordinate attitudes to the job and budgets can be expected if both subordinate and superior authoritarianism are considered together. The results indicate that budgetary participation is important in its own right and the homogeneous authoritarian dyads are positively associated with subordinate outcomes. Moreover, participation is more strongly associated with subordinate job satisfaction and budgetary attitudes in the homogeneous than in the heterogeneous dyad.

RECENT research into the effectiveness of participation in budgeting has focused on the moderating effects of situational factors [Brownell, 1982]. There is substantial evidence that personality is one such important factor [Vroom, 1960; Hofstede, 1967; Swieringa and Moncur, 1975; Brownell, 1981; Seiler and Bartlett, 1982]. Of a variety of personality variables, authoritarianism has been the most widely studied in participative budgeting research. The results have been equivocal, with some studies demonstrating that participation is most effective for low authoritarians [Vroom, 1960; Hofstede, 1967], while others have found no such effect [Foran and DeCoster, 1974; Abdel-Halim and Rowland, 1976].

In this paper it is argued that mixed results are a consequence of examining the authoritarianism of only one individual, usually the subordinate, in the joint decision process involved in participative budgeting. It is hypothesized that the effects of participative budgeting on subordinates' satisfaction with their jobs and the budgets will be influenced by the configuration of authoritarianism between the subordinate and superior. Furthermore, it is proposed that positive attitudes toward participative budgets will be stronger in dyads comprised of subordinates and superiors who have the same levels of authoritarianism, be that high or low. The empirical results support the proposed stronger association between participation in budgeting and subordinates' satisfaction with their jobs and the budget

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in the homogeneous compared with the heterogeneous dyads.

The remainder of the paper is organized as follows. First, the theoretical discussion related to the dyadic configurations of authoritarianism is presented. This is followed, in turn, by sections addressing the research method, an analysis of the results, and a discussion of the limitations and implications of the research.

THEORETICAL DEVELOPMENT

The unit of analysis in studies of participative budgeting typically has been the individual, usually the subordinate. However, the processes affecting the attitudes and performance of subordinates involve interpersonal exchanges between a variety of individuals throughout the work situation. Such exchanges include subordinate-superior interactions, peer group relationships, and exchanges between those within the work group and individuals outside the group. This study reports the results of a first step in broadening the unit of analysis used to examine the effectiveness of participative budgeting. The research uses personality theory to focus on the relationship between subordinate and superior to predict how budgetary participation affects subordinate attitudes.

The importance of studying the personality of both parties in situations involving personal exchanges is noted by Terhune [1970]. He argues that rather than studying single individuals it is more appropriate

> . . . to form theory and research on the form of system behaviour resulting from the particular configuration of the dispositions of the *two* or more actors in the interaction [Terhune, 1970, p. 228, emphasis added].

Such an approach acknowledges that the influence of personality on an individual's behavior is a function of the separate predispositions of involved individuals together with the outcome of their interpersonal interaction, rather than those of single individuals. This type of analysis supports examination of a variety of dyadic configurations to describe superior/subordinate relations, and hence promotes a greater understanding of the effects of participation on the subordinate.

To examine the way in which dyadic configurations of authoritarianism moderate the effects of participation in budgeting, this section examines the attitudes of the subordinate and superior who vary in authoritarianism. It is argued that these attitudes create situations where subordinate satisfaction with work and budgets will be affected. The potential for authoritarianism to affect individuals' work attitudes has been widely discussed in both psychology [Deutsch, 1960; Haythorn, et al., 1956; Schultz, 1955; Slack & Cook, 1973; Sanford, 1956] and more specifically in accounting [Vroom, 1960; Hofstede, 1967; Foran & DeCoster, 1974]. The study does not attempt to associate authoritarianism with effective decision making. Associations between personality and performance variables are unlikely to be identified because of the diversity of factors and complexity of relationships affecting performance [Libby and Lewis, 1982, p. 272]. Dirsmith and Lewis [1980] pointed out that personality variables influence the perceptual rather than the executive (decision) subsystem.

Broadly conceived, there are four possible combinations of dyads defined in terms of authoritarianism. Two of these are heterogeneous in the sense that either the superior is high on authoritarianism and the subordinate is low, or the superior is low and the subordinate is high. Two of the dyads are homogeneous in that both the superior and subordinate are high or both are low on authoritarianism.

It is proposed that in the heterogeneous dyads, participative budgeting will be associated with impaired subordinate attitudes to the job and the budget. Consider the dyad involving a high authoritarian superior and a low authoritarian subordinate. The superior typically prefers personal interactions based on power and authority [Sanford, 1956], and believes these interactions to be less trustworthy [Deutsch, 1960] and to be highly competitive [Bixenstine and O'Reilly, 1966]. In addition, the superior is likely to be more autocratic and less concerned with group approval [Haythorn, et al., 1956]. Low authoritarian subordinates who, by definition, do not share these attitudes may find that the personal exchanges forced by participation result in frustration and antagonism and hence a decrease in job satisfaction and the perceived usefulness of budgeting. In the converse heterogeneous dyad, a high authoritarian subordinate who expects guidance and the assignment of responsibilities [Adorno, et al., 1950; Kahn, et al., 1964] is likely to respond aggressively to a low authoritarian superior who does not fulfill these expectations [Adorno, et al., 1950]. Such behavior might be exacerbated by the personal exchanges involved in participation, and as a consequence diminished satisfaction with the job and budgeting may occur.

None of the above problematic interpersonal exchanges is likely to be as apparent in the dyads of matched authoritarians. In the situation where both parties are low authoritarians, participation will involve cooperative and trusting exchanges with the likelihood of enhanced subordinate satisfaction. Similar positive effects may occur in the high authoritarian dyad, where the subordinate will accept and respond positively to the superior's tendency to rely on power and authority in the participative process [Sanford, 1956].

The extent to which poor job attitudes would persist because of the proposed personality mismatches depends on the ability of subordinates to transfer from heterogeneous to homogeneous dyads. This raises the broader issue of self-selection by employees into work situations of their own choice. It seems likely that transaction costs of relocating and situational variables would influence this self-selection process. Relevant factors would include available alternative employment opportunities, type of task, organizational size, employee's seniority, and status within the organization.

Hypotheses

While the primary focus of the present study is on the moderating influence of authoritarian dyads on the effects of participative budgeting, it is usual practice in contingency-type studies of this nature to report the effects of the independent variables acting singly. The evidence on the direct effects of participation in budgeting is equivocal, with some studies showing positive effects [Argyris, 1952; Brownell, 1982; Hofstede, 1967; Kenis, 1979] and others showing no effects [Milani, 1975; Morse and Reimer, 1956]. While there are no accounting studies employing a dyadic configuration of authoritarianism, evidence from psychology tends to support a direct effect between homogeneous dyads and favorable attitudes [Slack and Cook, 1973; Deutsch, 1960; Haythorn, et al., 1956; Schultz, 1955].

To provide for a comprehensive testing of the model, including the effects of the independent variables acting singly and the moderating effect of the dyadic configurations on participation, three hypotheses are presented.

Hypothesis 1: There is no significant relationship between budgetary participation and

1) subordinate job satisfaction;
2) subordinate satisfaction with budgets.

Hypothesis 2: There is no significant relationship between authoritarian dyad type and

1) subordinate job satisfaction;
2) subordinate satisfaction with budgets.

Hypothesis 3: There is no significant interaction between authoritarian dyad type and budgetary participation affecting

1) subordinate job satisfaction;
2) subordinate satisfaction with budgets.

METHOD

The sample of the study consisted of departmental managers and supervisors drawn from nine manufacturing organizations within a single industry, each of which employed more than 250 individuals. The average department size was 32 individuals. Forty-two departmental managers were contacted during the initial stage of the project. Each manager provided a list of all supervisors within his/her department. One supervisor was selected, at random, from each department.

Questionnaires were given to participants during a short introductory interview where the confidentiality of the research was assured. Supervisors received questionnaires dealing with authoritarianism, participation in budgeting, job satisfaction, and satisfaction with budgets. Managers were asked to complete the authoritarianism questionnaire only. To minimize response bias, participants were asked to complete their questionnaire in private and return it to the researcher one hour after the initial distribution interview. Thirty-nine usable matched response pairs were provided, with participants in three pairs providing incomplete responses.

The average age of the managers was 41 years, and they had been employed in their current organizations for an average of six years. The average age of supervisors was 37, and they had been in their existing positions on average for three years. Managers were at middle to lower levels in their organizations. Of the 39 managers, 27 had profit center responsibility while 12 had responsibility over costs only. All supervisors had cost center responsibility. The work situations of subordinates involved relatively routine tasks.

THE MEASURES

Authoritarianism

The *F*-scale as developed by Adorno, et al. [1950] and applied in accounting studies by Foran and DeCoster [1974] and Seiler and Bartlett [1982] was used to measure authoritarianism. This 30-item instrument has been well tested in previous research and a Cronbach [1951] alpha reliability measure of 0.87 in the current study was consistent with other research using authoritarianism [Adorno, et al., 1950].

The research sought to combine the authoritarianism of subordinate and superior to specify the four dyadic configurations. This was achieved by taking the overall mean of both subordinates and superiors and classifying those with scores less than the mean as low in authoritarianism and those greater than the mean as high in authoritarianism. The authoritarianism scale ranged from 47 to 151 and the mean value used as the criterion to differentiate high from low authoritarianism was 95.42 (see Table 2). Table 1 reports the nature of the dyadic configuration and the number of observations in each cell.

TABLE 1
DYADIC CONFIGURATION—CELL NUMBERS

		Superior authoritarianism	
		Low	*High*
Subordinate authoritarianism	*Low*	11	9
	High	10	9

Participation

Budgetary participation was measured using the Milani [1975] six-item scale. This measure was selected because of its multi-item nature and previously demonstrated validity [Brownell, 1982]. The internal reliability of the scale was 0.79 using Cronbach's alpha statistic.

Job Satisfaction

Job satisfaction was measured by the 20-item version of the Minnesota Satisfaction Questionnaire (MSQ) [Weiss, et al., 1967]. This scale has been extensively studied and tested, and has high levels of discriminant validity [Dunham, et al., 1977].

Satisfaction with Budgets

Satisfaction with budgets was measured by a five-item scale drawn from Swieringa and Moncur [1975] which has been used by Merchant [1981] and Kenis [1979]. These items measure the perceived usefulness or satisfaction of budgets to respondents. The internal reliability of this measure was 0.75. Table 2 provides the descriptive statistics for these measures.

RESULTS

The hypotheses were tested using regression analysis. The following equation expresses the hypothesized relationships.

$$W_i=\beta_{1i}+\beta_{2i}X+\beta_{3i}Y+\beta_{4i}XY$$

where

W = budgetary outcomes $i=1,2$; 1 = job satisfaction; 2 = satisfaction with budgets,
X = budgetary participation,
Y = a binary variable related to the dyadic configurations—
+1 for homogeneous groups;
−1 for heterogenous groups, and
XY = the interaction between participation and dyadic configurations.

The interaction term was constructed by rescoring participation before combining with the personality dyad binary variable. This involved subtracting the mean participation scores from the raw scores to code high participation positively, and low participation negatively. This enabled the sign of the interaction term to reflect the predicted relationship between participation and the dyadic configurations.[1] The proposition related to the in-

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[1] The scoring of the interaction term was as follows: the positively scored high participation combined with the positive binary score of the homogeneous dyads to generate a positively signed, continuously measured interaction term. Similarly, the negatively signed low participation combined with the negative binary score of the heterogeneous dyad to produce a positive interaction term. Conversely, combinations of positive high

TABLE 2
DESCRIPTIVE STATISTICS

	Mean	Standard Deviation	Range	
			Possible	Actual
Job satisfaction	65.42	19.50	20–100	32–95
Satisfaction with budgets	15.08	3.40	4–20	10–20
Participation	28.23	9.98	1–42	10–40
Authoritarianism:				
Subordinate	98.40	34.32	30–210	47–151
Superior	92.91	29.32	30–210	60–140
Total	95.42	31.20	30–210	47–151
Low authoritarians:				
Subordinates	78.52	24.21	30–95	47–94
Superiors	78.73	24.82	30–95	60–92
High authoritarians:				
Subordinates	120.16	43.40	96–210	99–151
Superiors	109.46	38.70	96–210	98–140

teraction would be supported if the sign of β_4 was significantly larger than zero [Brownell, 1982]. The independence of participation and the dyadic configuration was tested by examining the numbers of homogeneous and heterogeneous dyads in the categories of high (+ scores) and low (− scores) participation. Using a chi-square test, the variables were found to be unrelated ($X^2=0.25$, $dF=1$, not significant).

The results presented in Table 3 indicate that in addition to the significance of participation, the dyadic configuration of authoritarianism is associated with both job satisfaction ($p<.05$) and satisfaction with budgets ($p<.05$).[2] From the regression it can be seen that the interaction term also is significant in the predicted direction for job satisfaction ($p<.01$) and satisfaction with budgets ($p<.01$). Furthermore, tests of the incremental explanatory power indicated that the model including the interaction term explains a significantly greater proportion of variance in job satisfaction ($F=5.48, p<.05$, df 1,35) and satisfaction with budgets ($F=7.27, p<.05, df$ 1,35) than does the model without the interaction term.[3]

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participation and negative heterogeneous dyads; and negative low participation and positive homogeneous dyads produced negative interaction terms.

[2] The importance of considering dyadic configurations of authoritarianism rather than either the authoritarianism of subordinate or superior acting independently was tested by examining the correlations between the attitudinal outcomes and both subordinate and superior authoritarianism. The correlation between subordinate authoritarianism and job satisfaction was 0.14 and satisfaction with budget was 0.19, which are not significant at $p<.10$. The correlation between superior authoritarianism and job satisfaction was 0.21 and satisfaction with budgets was 0.26, which are not significant at $p<.10$ and $p<.05$, respectively.

[3] Test of the significance of the introduction of the interaction term into the model followed procedures prescribed by Pedhazur [1982, p. 449].

TABLE 3
RESULTS OF REGRESSIONS

Job Satisfaction *Coefficient*	*Value*	*t*	*Probability*
β_{11} (constant)	44.03	3.96	<.01
β_{21} (budgetary participation)	0.71	2.45	<.05
β_{31} (dyadic configuration)	0.63	2.23	<.05
β_{41} (interaction)	0.80	3.30	<.01
Adjusted R^2=19.5%			
Satisfaction with *Budgets*			
β_{12} (constant)	11.78	9.23	<.01
β_{22} (budgetary participation)	0.11	2.50	<.05
β_{32} (dyadic configuration)	0.19	2.24	<.05
β_{42} (interaction)	0.95	5.32	<.01
Adjusted R^2=24.4%			

The correlation between job satisfaction and satisfaction with budgets was 0.22, which is not significant at $p<.10$. This assured the independence of the two regression analyses. Two-tailed tests of significance were used in the analyses.

While parametric statistics typically are used in studies of this nature, there is always some concern that measurement procedures, small sample size, and strict adherence to the assumptions of normal distributions with homogeneous variance may violate the use of these techniques. While the distributions in this study were not very different from normal, the small sample size and measurement techniques justified the use of additional statistical testing. Several nonparametric statistics were calculated for the bivariate associations between the dependent variables and each of the independent variables. Table 4 reports the results of these statistics, and provides additional support for the proposed associations.

The results of the regressions and the nonparametric statistics are consistent with rejection of all three hypotheses. The analysis supports the view that participation alone exerts an influence on attitudinal factors of job satisfaction and satisfaction with budgets. The dyadic configurations of authoritarianism between subordinate and superior were related to both outcomes, with homogeneous dyads producing higher values. In addition, the moderating effect of the dyadic configurations on effective participation was demonstrated for both outcome variables in the predicted direction.

CONCLUSION

The results of this study suggest that our understanding of the effects of participative budgeting can be improved by including the authoritarianism of superiors and subordinates involved in the budgetary situation as a moderating variable.

In particular, the results are consistent with studies by Argyris [1952], Hofstede [1967], Swieringa and Moncur [1975], Kenis [1979], and Brownell [1982] which identify the significant effects that participation has on attitudinal outcomes. An important finding was the existence of

TABLE 4

RESULTS OF NONPARAMETRIC STATISTICS

Job Satisfaction	*Participation*	*Authoritarianism Dyad*	*Interaction Term*
Spearman Rank Correlation (r_s) $n=39$	$0.39, p<.01$		$0.32, p<.01$
Mann-Whitney u $n_1=20, n_2=19$		$101, p<.05$	
Satisfaction with Budgets			
Spearman Rank Correlation $n=39$	$0.35, p<.01$		$0.33, p<.01$
Mann-Whitney u $n_1=20, n_2=19$		$94, p<.01$	

significant associations between outcomes and dyadic configurations of authoritarianism. These results are consistent with findings in psychology that relate homogeneous authoritarian dyads to cooperative personal exchanges [Slack and Cook, 1973; Haythorn, et al., 1956] and for low authoritarian dyads, trusting behavior [Deutsch, 1960]. In addition to the importance of dyadic configurations of authoritarianism acting alone, the results also demonstrated that the dyadic variable acts as a moderating factor in participative budgeting. It is possible that the inconsistency of existing accounting research findings on the effects of subordinate authoritarianism in participative budgeting situations may be explained in part by the failure of these studies to account for the personality of the other member of the dyad (the superior).

The findings of this research should be considered within the limitations of the study. The number of observations in the low satisfaction heterogeneous dyads indicates that subordinates could not self-select into a preferred job situation. This may have been a consequence of few alternative employment opportunities available to the subordinate group. Situational factors such as the small size of the firms and the relative maturity of subordinates may have restricted employee mobility, and as a consequence limit the generalizability of the findings. The sample size was relatively small, thus limiting the reliability of the results. The study examined only conventional, attitudinal outcomes. Other measures of the effects of personal exchanges may have revealed additional insights. For example, it may have been helpful to have measured such dynamics of the groups as conflict and cooperation. The study focused only on a single personality variable, and the way in which the effects of authoritarianism depend upon other personality and situational variables was not addressed. Finally, the usual care should be exercised in imputing causality from studies of this kind which employ cross-sectional, single-period research designs.

However, given these limitations, the results of the study do indicate that improved understanding of the situations in which participative budgeting leads to improved attitudes toward the job and the budget may be found by focusing on personality attributes of both parties involved in participative budgeting. Future research into participative budgeting may benefit from approaches which investigate, specifically, the relationship between superiors and others involved in budget formulation, using theories related to the processes of personal interactions.

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The Information Content of FAS 33 Returns on Equity

Brock Murdoch

ABSTRACT: This research examines the ability of FAS 33 returns on equity to explain security returns. Initially, the ability of FAS 33 returns to add to the explanatory power of historical cost returns is assessed. Subsequently, the ability of historical cost returns to add to the explanatory power of FAS 33 returns on equity is evaluated. Data for 1980, 1981, and 1982 are analyzed. A matched-pair design is used to control for the effects of cross-sectional correlation on the dependent and independent variables. Four versions of FAS 33 returns on equity are tested. Results indicate that constant dollar, current cost, and net holding returns do not demonstrate information content incremental to historical cost returns in explaining security price changes. Purchasing power returns on equity, however, are shown to possess *incremental* information content. Furthermore, results indicate that while historical cost returns on equity do increase the ability of constant dollar, purchasing power, and net holding returns on equity to explain security price changes, historical cost returns do not increase the explanatory power of current cost returns on equity.

BEAVER and Landsman [1983] reported on the information content of historical cost and Statement of Financial Accounting Standards No. 33 (FAS 33) data. They found substantial evidence that historical cost data possess information content incremental to FAS 33 data, but little evidence that FAS 33 data possess any information content beyond that already contained in historical cost data. This study provides further evidence of the ability of FAS 33 disclosures to explain security price movement.

Beaver and Landsman's "data fail to present a clear-cut finding" [1983, p. 63] regarding the incremental information content of FAS 33 variables. However, a review of their data suggests that their FAS 33 *return on equity* variables possess greater incremental information content than most of their *earnings change variables*. Accordingly, the information content[1] of FAS 33 *returns on equity*, relative to the information content of historical *returns on equity*, is the focus of this research. Little can be gained by testing th information content of FAS 33 disclosure without relating such disclosures to thos of historical cost. Since the historical cos model is well established as the primar method of financial data disclosure, fo FAS 33 data to be recognized as useful i the explanation of security returns, thes

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[1] *Information content* is defined "as the ability of dat to explain changes in stock prices. . ." [Beaver an Landsman, 1983, p. 1]. The terms *information conten* and *explanatory power* are treated as synonyms herein.

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data must be shown to possess information content *incremental* to historical cost data.

Four returns on equity, based on the various constant dollar and current cost data disclosed in FAS 33, are investigated herein. The initial tests of these data seek to establish the existence of *incremental* information content in explaining security prices. Subsequently, the incremental information content of the historical cost data is evaluated to put these data to an equivalent test. The following hypotheses, then, are tested herein:

H_1: FAS 33 returns on equity possess incremental information content (beyond that provided by historical cost returns on equity) in explaining security returns.

H_2: Historical cost returns on equity possess incremental information content (beyond that provided by FAS 33 returns on equity) in explaining security returns.

SAMPLE SELECTION AND DATA ACQUISITION

The population of firms from which the sample for this research is drawn is contained in the *FASB Statement 33 Data Bank User's Manual* [Vasarhelyi, Phillips and Yang, 1983]. The *User's Manual* identifies 1,370 firms required to disclose FAS 33 data. For firms that have no material difference between their amount of income from continuing operations on a constant dollar basis and their amount of income from continuing operations on a current cost basis, the current cost information need not be disclosed [FASB, 1979]. As a result of this policy, most financial firms did not report their activities on a current cost basis. Since this research involves a comparison of all three measurement alternatives, financial firms were excluded from sampling consideration. These exclusions reduced the potential sample from 1,370 to 1,105 firms.

The sample was further reduced for additional reasons. Only calendar-year firms are used in testing the hypotheses. Also, to be considered for inclusion in the sample, a firm must be listed in the *Value Line Investment Survey*. Both these exclusions are made to facilitate the matching process used to control for cross-sectional correlation discussed later in this paper. Furthermore, only firms listed on the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX) are included. Beaver cites evidence that the over-the-counter market receives little attention from analysts and "may be inefficient with respect to many items of information" [1981, p. 156]. Over 93 percent of the firms contained in the *User's Manual* are NYSE or AMEX firms [Beaver and Landsman, 1983]. These combined deletions reduced the potential sample to 619 firms.

After the list of potential firms had been finalized, each of the organizations was sent a letter requesting a copy of its 1982 annual report. Since each firm is required to present a five-year summary of FAS 33 data, the 1982 annual report includes the desired information for the years 1979 through 1982. (This is only four years of data, since the first year FAS 33 was in effect was 1979.)

RESEARCH METHOD

Periods of Return Measurements

Any study comparing the ability of historical cost and FAS 33 disclosures to explain security price movements must address the issue of the different timing of the disclosures. Historical cost data are disclosed through quarterly financial statements, quarterly and annual earnings announcements, annual reports, and 10-K filings with the SEC. The constant dollar and current cost data required by FAS 33, however, are only disclosed in the annual and 10-K reports. This means that, through the quarterly reporting process, three-quarters of the historical cost data are "known" to the securities markets prior to the disclosure of any of the constant dollar and current cost data.

Initially, security returns were measured over two test periods. First, security returns were measured over the firms' fiscal year under the assumption that all historical cost and FAS 33 data *are impounded into security prices prior to disclosure.* Secondly, security returns were measured over an annual period "lagged" by three months. For example, for 1980 this "lagged" annual period is from April 1, 1980 to March 31, 1981 and normally includes all public disclosures of accounting information for firms having a 1980 calendar year. Public disclosure of both the historical cost and the FAS 33 data "is assumed to occur during the twelve-month interval ending the third month after the end of the fiscal year . . ." [Beaver, Clarke and Wright, 1979, p. 322]. The use of security returns measured over this latter period assumes that security returns *react to the disclosure* of the historical cost and FAS 33 data.

Preliminary investigation indicated that, for both historical cost and FAS 33 data, correlations between accounting and security returns are substantially higher when security returns are measured concurrently with accounting returns (i.e., over the fiscal year) than when security returns are measured over an annual period "lagged" by three months. Relative results were substantially the same regardless of over which period the security returns were measured. Consequently, the results reported herein are based on the measurement of the security returns over the firms' fiscal year. Results from the analysis of the "lagged" annual period are available on request.

Definition of Accounting and Security Returns

The issue addressed in this paper involves the ability of historical cost and a variety of FAS 33 returns on equity to explain security price movements. These various historical cost, FAS 33, and security returns are designated notationally as follows:

H = historical cost return on equity $= HCI/((HCA_B + HCA_E)/2)$;
CD = constant dollar return on equity $= CDI/((CDA_B + CDA_E)/2)$;
CC = current cost return on equity $= CCI/((CCA_B + CCA_E)/2)$;
PP = purchasing power return on equity $= PPG/((CDA_B + CDA_E)/2)$;
NH = net holding return on equity $= NHG/((CCA_B + CCA_E)/2)$;
S = security return $= (SP_E + CD - SP_B)/SP_B$,

where

HCI = historical cost income from continuing operations;
CDI = constant dollar income from continuing operations;
CCI = current cost income from continuing operations;
HCA = historical cost net assets;
CDA = constant dollar net assets;
CCA = current cost net assets;
PPG = purchasing power gain on net monetary items;
NHG = net holding gain (increase in the current cost amounts of inventory and property, plant and equipment, net of inflation);
SP = security price;
CD = cash dividends paid;
B = subscript indicating the variable is measured at the beginning of the fiscal year; and

E=subscript indicating the variable is measured at the end of the fiscal year.

The measures represented by these variables have been discussed extensively in accounting literature (see, for example, Edwards and Bell [1961], Johnson and Bell [1976], Revsine [1981], Sterling [1975], Belkaoui [1981] and Beaver and Landsman [1983]), and the conceptual and empirical evidence warrants an investigation of the role these variables play in explaining stock price movements.

Matched Pair Design

Ball and Brown [1968] did one of the earliest studies investigating the relationship between accounting earnings and stock prices. They recognized that, historically, "the incomes of firms have tended to move together" [p. 161]. That is, a portion of a firm's income is influenced by industry and economy-wide (systematic) factors. The remaining portion is the result of firm-unique (unsystematic) factors. Ball and Brown employed a least-squares model to estimate the unsystematic portion of a firm's income by regressing the change in the firm's income on the change in the average income of all firms.

Similarly, Ball and Brown recognized that security prices of firms tended to move together, too. That is, these same industry and economy-wide (systematic) factors affected security returns as well as income. Again, the least-squares regression model was used to separate the systematic and unsystematic portions of the security return by regressing the firm's security return on the return of the market portfolio.

This method of controlling for confounding events, or variations of it, became commonplace. However, Beaver, Griffin and Landsman [1982] found no difference in results (in the association between ASR No. 190 data and stock returns) regardless of whether raw or residual returns were specified as the dependent variable. Furthermore, several accounting studies have used various asset-pricing models to control for confounding events with little resulting difference. Ricks [1982] used four return metrics in investigating the reaction of stock prices to the adoption of LIFO: raw returns, residual returns, and two versions of the market model. "The various return metrics produced virtually identical results . . ." [p. 374]. Such evidence indicates that use of the market model alone to control for confounding events is probably inadequate. Consequently, this research uses a matching process based on *Value Line* industry classifications *and* security betas as controls for systematic influences on both the dependent and independent variables.

Theoretically, if two firms are matched by industry and other common economic factors, any *difference* in their security returns measured over the same period is caused by influences unique to each firm. Similarly, any *difference* in their accounting returns on equity is caused by firm-unique factors. *To the extent that accounting returns contain information content in explaining security returns, the magnitude of the difference in security returns will be correlated to the magnitude of the difference in accounting returns.* While it is not practically possible to match firms so that all systematic influences are controlled, firms can be matched on important factors that account for much of the common variation in their accounting and security returns. The difference in the accounting and security returns of matched firms will approximate the unique difference between the two firms. These differences in pairs of security returns and accounting returns are measured for many matched firms to evaluate the relationship between security and accounting returns.

Initially, sample firms are grouped by industry according to their classification published in the *Value Line Investment Survey*. Once firms are classified by industry, the firms within each industry are ordered from lowest to highest according to the value of their beta reported in the *Value Line Investment Survey*. Matched pairs are determined based on the proximity of betas within each industry. Some of the matched pairs have identical betas. In other cases, where identical matches are not possible, matched pairs have similar, but not identical, betas. In instances where several firms from the same industry classification have identical betas, firms are randomly matched.

The variables H, CD, CC, PP, NH, and S represent the "raw" returns for individual firms. By computing the difference in each of these variables for each matched pair, a set of six (one historical cost, four FAS 33, and one security) return differences for each matched pair is generated. Each return difference is designated by prefacing the variable denoting the type of return by "Δ." The variables representing the various return differences are:

ΔH = difference in historical cost returns on equity;
ΔCD = difference in constant dollar returns on equity;
ΔCC = difference in current cost returns on equity;
ΔPP = difference in purchasing power returns on equity;
ΔNH = difference in net holding returns on equity; and
ΔS = difference in security returns.

Statistical Tests

The initial issue addressed is the ability of FAS 33 data to increase the explanatory power of historical cost data in explaining security returns. The proportion of variation in security returns that is explained by the various accounting returns is measured by the coefficient of determination (for simple regressions), r^2, and the coefficient of multiple determination (for multiple regressions), R^2. By comparing r^2, obtained by regressing[2] ΔS on ΔH, to "corrected" R^2, obtained from regressing ΔS on ΔH *and* each of the various FAS 33 return differences (ΔCD, ΔCC, ΔPP, and ΔNH), it can be observed whether a greater proportion of the variation of ΔS is explained by including the FAS 33 return differences in the regression. The correction of R^2 is necessary because, with the inclusion of additional explanatory variables, R^2 is artificially increased, "regardless of whether the additional variables are significant or not" [Fogler and Ganapathy, 1982, p. 53]. The correction (for degrees of freedom) of the multiple coefficient of determination (R^2) allows for the comparison of r^2 and R^2.

Secondly, the issue of whether historical cost data possess incremental information content is considered. Similar to the former analysis, r^2 from the simple regression of ΔS on each of the FAS 33 variables (ΔCD,ΔCC,ΔPP,ΔNH) is compared to the corrected R^2 values from the multiple regressions of ΔS on each of the FAS 33 variables (ΔCD, ΔCC, ΔPP and ΔNH) *and* ΔH.

In cases where the corrected R^2 values exceed the r^2 values, the differences in the associated *sums of the squared errors (residuals)* are tested for significance. If the corrected R^2 value for a particular multiple regression exceeds the r^2 value of the simple regression being compared, the sum of the squared errors will be *less* for the multiple regression. Fogler and Gan-

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[2] All regressions in these analyses are made using deviations from the means of the data. Consequently, the intercepts are not reported. In the alternative analyses, none of the intercepts were significant.

TABLE 1

SAMPLE SELECTION DATA

Annual report requests sent to NYSE and AMEX calendar year firms	619
Undeliverable requests	16
Requests reaching destination (100%)	603
Annual reports not received (including four de-listed firms)	50
Annual reports received (91.7%)	553
Firms eliminated for incomplete data	177
Firms for which accounting and security returns were computed	376
Unmatched firms (odd number of firms in industry)	38
Matched firms	338
Number of possible observations per year (338/2)	169

apathy [1982, p. 55] provide the appropriate statistic to test the difference in the sums of squared errors for significance.

The null and alternative hypotheses for H_1 are stated operationally as:

H_0: $SSE_H - SSE_{33} \leq 0$
H_a: $SSE_H - SSE_{33} > 0$

where

SSE_H = sum of the squared errors for simple regressions containing only the historical cost independent variable and
SSE_{33} = sum of the squared errors for multiple regressions containing historical cost and FAS 33 independent variables.

For H_2, the null and alternative hypotheses to test are:

H_0: $SSE_{33} - SSE_H \leq 0$
H_a: $SSE_{33} - SSE_H > 0$

where

SSE_{33} = sum of the squared errors for simple regressions containing only the FAS 33 independent variable and
SSE_H = sum of the squared errors for multiple regressions containing FAS 33 and historical cost independent variables.

The statistical analysis is conducted for the years 1980, 1981, and 1982. In addition, the means of the accounting and security returns for all three years (1980, 1981, and 1982) are computed and analyzed.[3] The rationale for analyzing the three-year means for all returns involves the possibility that FAS 33 returns may not be as rapidly reflected in security prices as are historical cost returns. FAS 33 disclosures are not as timely and are not disclosed as comprehensively or as prominently as are historical cost disclosures. A longer test period allows a longer time for the securities markets to impound the information from FAS 33. Consequently, the three-year mean analysis may result in a fairer test of FAS 33 data. At the same time, this longer period can be used to resolve inconsistencies in the year-to-year results.

RESULTS

Sample Results

A previous section discussed the makeup of the 619 firms that were mailed requests for their 1982 annual report. Table 1 presents the sample selection data. Of the 603 requests that reached the addressee, 553 annual reports were re-

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[3] For example, the mean for ΔH represents the addition of ΔH for 1980, 1981, and 1982, divided by three.

TABLE 2

CLASSIFICATION OF SAMPLE FIRMS BY *Value Line* Industry

Industry	*No. of Firms*	*Percent of Firms*
Aerospace/Diversified	8	2.38
Air Transport	14	4.14
Apparel	2	.59
Auto & Truck	2	.59
Auto Parts—Original Equipment	2	.59
Auto Parts—Replacement	4	1.18
Brewing	2	.59
Broadcasting	2	.59
Building	20	5.92
Cement	4	1.18
Chemical—Basic	4	1.18
Chemical—Diversified	4	1.18
Chemical—Specialty	2	.59
Coal/Uranium/Geothermal	4	1.18
Distilling/Tobacco	2	.59
Electrical Equipment	6	1.78
Electrical Utility—Central	28	8.29
Electrical Utility—East	22	6.51
Electrical Utility—West	14	4.14
Electronics	6	1.78
Food Processing	8	2.38
Grocery	4	1.18
Home Appliance	4	1.18
Hotel/Gaming	4	1.18
Industrial Services	2	.59
Lead, Zinc, & Mining Materials	4	1.18
Machinery	6	1.78
Machinery—Construction	2	.59
Machine—Tool	2	.59
Maritime	2	.59
Metal Fabricating	4	1.18
Metals & Mining—General	10	2.96
Multiform	4	1.18
Natural Gas	24	7.10
Newspaper	6	1.78
Oilfield Services	4	1.18
Packaging & Containers	8	2.38
Paper & Forest Products	12	3.55
Petroleum—Integrated	20	5.92
Petroleum—Producing	2	.59
Precision Instrument	2	.59
Publishing	4	1.18
Railroad	4	1.18
Railroad Equipment	2	.59
Railroad/Resources	4	1.18
Recreation	2	.59
Shoe	2	.59
Steel—General	4	1.18
Steel—Integrated	8	2.38
Steel—Specialty	2	.59
Sugar	2	.59
Telecommunications	6	1.78
Textile	4	1.18
Tire & Rubber	2	.59
Trucking/Transport Leasing	6	1.78
	338	100.00

ceived, representing a 91.7 percent response rate.

The table indicates that 177 firms were deleted from the sample because of incomplete data. These deletions occurred because not all firms are required to report both constant dollar and current cost information. These 177 firms did not report the same constant dollar and current cost data as most other firms because of exemptions allowed under FAS 33 or Statement of Financial Accounting Standards No. 70 (FAS 70). FAS 33 requires firms that have no material difference in their amounts of constant dollar and current cost information to disclose only constant dollar data [FASB, 1979]. FAS 70 exempts firms having extensive foreign currency transactions from disclosing constant dollar information [FASB, 1982].

An additional 38 firms were deleted because there was an odd number of firms in the industry classification. The matching process in these cases resulted in one "left-over" firm. The total number of matched firms was, therefore, reduced to 338.

The research method calls for taking the differences between two firms' accounting and security returns. Therefore, for each year (1980, 1981, 1982) there are $338 \div 2 = 169$ possible observations. Data were missing for ten firms in one or two of the three years. Consequently, the actual numbers of observations included in the analysis are 161 for 1980, 168 for 1981, 167 for 1982, and 159 for the three-year mean.

The aforementioned exemptions allowed under FAS 33 and FAS 70 affect the disclosure requirements of firms in some industries more than in others. That is, many industries are not represented in the sample, or are represented only by a small proportion of the firms making up the industry. This study does not address the issue of how industry representation might have affected results. The utility of the *required* constant dollar and current cost disclosures, and not the utility of constant dollar and current cost measures in general, is of primary interest herein. Nevertheless, an industry breakdown of the 338 firms comprising the sample, based on *Value Line's* classification, is displayed in Table 2.

Variation in Matching Process

Recall that firms are grouped first by industry and then matched within each industry based upon the proximity of their *Value Line* beta. That is, many of the matched firms do not have identical betas. The mean beta difference from the 169 matches is 0.067 and the standard deviation of these differences is 0.084.

Results of Data Analysis

A correlation matrix of all variables for all three years and the three-year mean is displayed in Table 3. As one would expect, Table 3 indicates that security return differences (ΔS) are positively correlated with historical cost, constant dollar, and current cost return on equity differences (ΔH, ΔCD, and ΔCC) in all three years. In addition, a relatively strong and consistent negative relationship between purchasing power returns on equity (ΔPP) and the historical cost, constant dollar, and current cost returns on equity (ΔH, ΔCD, and ΔCC) is observed.

Table 4 presents the regression coefficients (b) and the coefficients of determination (r^2) from the simple regression of ΔS on ΔH. The figures in parentheses under the b coefficients are t-values, while the figures in parentheses under the r^2 values are F-ratios.

T-values and F-ratios are provided in all appropriate tables for completeness, but are not used in the tests of the hypotheses. For all simple regressions, the F-ratio is equal to the square of the t-value.

Turning to Table 5, we get an indication of whether the FAS 33 data possess *incremental* information content. The re-

TABLE 3

CORRELATION MATRIX OF RETURN DIFFERENCES

	Version of Return on Equity					
	ΔH	ΔCD	ΔCC	ΔPP	ΔNH	ΔS
ΔH: 1980	1.000					
1981	1.000					
1982	1.000					
Mean	1.000					
ΔCD: 1980	.914	1.000				
1981	.886	1.000				
1982	.860	1.000				
Mean	.885	1.000				
ΔCC: 1980	.792	.915	1.000			
1981	.802	.928	1.000			
1982	.820	.935	1.000			
Mean	.796	.924	1.000			
ΔPP: 1980	−.289	−.283	−.323	1.000		
1981	−.331	−.324	−.299	1.000		
1982	−.124	−.153	−.149	1.000		
Mean	−.310	−.289	−.288	1.000		
ΔNH: 1980	−.004	.032	.026	−.139	1.000	
1981	−.184	.039	.027	.031	1.000	
1982	−.176	.162	.168	−.098	1.000	
Mean	−.115	.070	.081	.003	1.000	
ΔS: 1980	.284	.269	.277	.045	−.046	1.000
1981	.379	.277	.267	−.045	−.117	1.000
.1982	.081	.075	.077	.131	.140	1.000
Mean	.228	.151	.212	.118	.051	1.000

TABLE 4

SUMMARY STATISTICS FOR REGRESSION OF SECURITY RETURN DIFFERENCES ON HISTORICAL COST RETURN ON EQUITY DIFFERENCES

$\Delta S = a + b\Delta H + e$

Regression of	1980		1981		1982		Mean	
	b	r^2	b	r^2	b	r^2	b	r^2
ΔS on ΔH	.807 (3.69)	.07827 (13.62)	.746 (5.31)	.14342 (28.20)	.218 (0.96)	.00123 (0.92)	.366 (2.89)	.04989 (8.35)

gression coefficients (b_2) for each FAS 33 variable are presented along with the corrected coefficients of multiple determination (R^2) from the regression of ΔS on ΔH *and* the four FAS 33 return differences ($\Delta CD, \Delta CC, \Delta PP$, and ΔNH). T-values and F-ratios are shown in parentheses below the b_2 (FAS 33) coefficients and corrected R^2 values, respectively. It is observed from a comparison of the r^2 values in Table 4 to the corrected R^2 values in Table 5 that several of these values increase because of the additional FAS 33 independent variable included in the regressions.

TABLE 5

SUMMARY STATISTICS FOR REGRESSION OF SECURITY DIFFERENCES ON HISTORICAL COST AND FAS 33 RETURN ON EQUITY DIFFERENCES $\Delta S=a+b_1\Delta H+b_2Z$ WHERE $z=\Delta CD$, ΔCC, ΔPP, OR ΔNH

Regression of ΔS *on* ΔH *and:*	*1980*		*1981*		*1982*		*Mean*	
	b_2	*Corr.* R^2	b_2	*Corr.* R^2	b_2	*Corr.* R^2	b_2	*Corr.* R^2
ΔCD	.281 (0.37)	.07328 (13.65)	−.837 (−1.81)	.15485 (31.60)	.136 (0.19)	−.00461 (0.24)	−.561 (−1.38)	.05635 (10.26)
ΔCC	.739 (1.20)	.08076 (15.06)	−.389 (−0.89)	.14238 (28.73)	.207 (0.30)	−.00426 (0.30)	.251 (0.71)	.04689 (8.77)
ΔPP	.895 (1.61)	.08740 (16.32)	.625 (1.22)	.14594 (29.54)	2.156 (1.66)	.01174 (2.97)	.990 (2.45)	.07910 (14.57)
ΔNH	−.161 (−0.63)	.07478 (13.93)	−.078 (−0.66)	.14054 (28.31)	.595 (1.54)	.00940 (2.57)	.160 (0.96)	.04942 (9.21)

TABLE 6

COMPARISON OF SUMS OF SQUARED ERRORS FOR TESTING THE INCREMENTAL INFORMATION CONTENT OF FAS 33 DATA

Year	*Regression of* ΔS *on* ΔH *Compared to Regression of:*	SSE_H-SSE_{33}	*F-ratio*	*Sig.*
1980:	ΔS on ΔH and ΔCC	270,000	1.40	.238
	ΔS on ΔH and ΔPP	490,000	2.57	.109
1981:	ΔS on ΔH and ΔCD	330,000	3.20	.073
	ΔS on ΔH and ΔPP	150,000	1.44	.230
1982:	ΔS on ΔH and ΔPP	730,000	2.75	.097
	ΔS on ΔH and ΔNH	630,000	2.37	.124
Mean:	ΔS on ΔH and ΔCD	97,668	1.90	.168
	ΔS on ΔH and ΔPP	299,062	5.97	.015

Specifically, by including, first, ΔCC and then ΔPP, these two multiple regressions show increases in the coefficient of determination for 1980. Likewise, including ΔCD and ΔPP increases the coefficient of determination for 1981, including ΔPP and ΔNH increases the coefficient of determination for 1982, and including ΔCD and ΔPP increases the coefficient of determination for the three-year mean.

Table 6 presents the amount of the reduction in the sums of squared errors for each of the multiple regressions that result in an increase in the corrected R^2 over r^2. The F-ratios and significance of the reduction in each of the sums of squared errors present direct evidence on the incremental information content of FAS 33 data.

Assuming a .10 significance level, current cost returns on equity do not appear to possess incremental information content, given that inclusion of this variable increases the coefficient of determination for 1980 only, and the difference in the sums of squared errors is not significant. A similar conclusion is found regarding net holding returns on equity, since the

TABLE 7

SUMMARY STATISTICS FOR REGRESSION OF SECURITY RETURN DIFFERENCES ON FAS 33 RETURN ON EQUITY DIFFERENCES

Regression of:	*1980*		*1981*		*1982*		*Mean*	
	b	r^2	*b*	r^2	*b*	r^2	*b*	r^2
ΔS on ΔCD	1.078 (3.51)	.07137 (12.30)	.839 (3.73)	.07565 (13.88)	.343 (0.92)	.00079 (0.85)	.363 (1.89)	.02177 (3.57)
ΔS on ΔCC	1.382 (3.64)	.07655 (13.26)	.969 (3.57)	.06964 (12.71)	.377 (0.96)	.00124 (0.93)	.586 (2.72)	.04439 (7.40)
ΔS on ΔPP	.318 (0.57)	.00201 (0.32)	−.276 (−0.53)	.00496 (0.28)	1.997 (1.55)	.00995 (2.39)	.580 (1.45)	.01275 (2.10)
ΔS on ΔNH	−.156 (−0.59)	.00215 (0.34)	−.189 (−1.52)	.01244 (2.30)	.643 (1.69)	.01274 (2.87)	.107 (0.63)	.00213 (0.39)

inclusion of this variable increases the coefficient of determination for 1982 only, and likewise, the difference in the sums of squared errors is not significant.

The tests of constant dollar returns on equity are not conclusive. Constant dollar returns do significantly increase the explanatory power of historical cost returns for 1981 data; however, this variable is not significant for 1980 or 1982. The three-year mean analysis of constant dollar returns falls short of the 90 percent confidence level (87.2 percent confidence is observed) specified for rejection of the null hypothesis. Thus, constant dollar returns on equity are found to possess incremental information content in explaining 1981 security returns, but this conclusion cannot be generalized.

The strongest case for the incremental information content of any FAS 33 variable is made for purchasing power returns on equity. In all three years and in the analysis of the three-year mean data, the inclusion of purchasing power returns in the regression increases the coefficient of determination. The significance levels displayed in Table 6 indicate that the specified confidence is achieved for 1982 (90.3 percent), is very close in 1980 (89.1 percent), but is not achieved in 1981 (77.0 percent). However, the mean analysis indicates that the incremental information content of this variable is highly significant. That is, we are 98.5 percent confident that purchasing power returns add to the explanatory power of historical data over the three-year period. Consequently, purchasing power returns on equity do possess incremental information content in explaining security returns.

To summarize the four tests of H_1, only purchasing power returns on equity clearly possess information content beyond that provided by historical cost returns. Tests for the incremental information content of constant dollar returns on equity are inconclusive. No evidence is uncovered to illustrate incremental information content for current cost or net holding returns on equity.

Turning to H_2, Table 7 presents statistics from the simple regression of ΔS on each of the FAS 33 returns on equity. Again, t-values and F-ratios are presented for completeness, but are not used in considering the question of incremental information content.

Table 8 displays b_2 coefficients and corrected R^2 values from the multiple regressions of ΔS on each of the FAS 33 returns

TABLE 8

SUMMARY STATISTICS FOR REGRESSION OF SECURITY RETURN DIFFERENCES ON FAS 33 AND HISTORICAL COST RETURN ON EQUITY DIFFERENCES

Regression of ΔS *on:*	*1980*		*1981*		*1982*		*Mean*	
	b_2	*Corr.* R^2	b_2	*Corr.* R^2	b_2	*Corr.* R^2	b_2	*Corr.* R^2
ΔCD and ΔH	.624 (1.15)	.07328 (13.65)	1.226 (4.08)	.15485 (31.60)	.147 (0.33)	−.00461 (0.24)	.700 (2.57)	.05635 (10.26)
ΔCC and ΔH	.470 (1.32)	.08076 (15.06)	.914 (3.89)	.14238 (28.73)	.119 (0.30)	−.00426 (0.30)	.249 (1.19)	.04689 (8.77)
ΔPP and ΔH	.902 (3.97)	.08740 (16.32)	.805 (5.43)	.14594 (29.54)	.259 (1.14)	.01174 (2.97)	.459 (3.52)	.07910 (14.57)
ΔNH and ΔH	.808 (3.68)	.07478 (13.93)	.728 (5.09)	.14054 (28.31)	.152 (0.66)	.00940 (2.57)	.380 (2.98)	.04942 (9.21)

TABLE 9

COMPARISON OF SUMS OF SQUARED ERRORS FOR TESTING THE INCREMENTAL INFORMATION CONTENT OF HISTORICAL COST DATA

Year	*Regression of* ΔS *on* ΔCD, ΔCC, ΔPP, *and* ΔNH *Compared to Regression of:*	$SSE_{33}-SSE_H$	*F-ratio*	*Sig.*
1980:	ΔS on ΔCD and ΔH	250,000	1.30	.254
	ΔS on ΔCC and ΔH	330,000	1.73	.190
	ΔS on ΔPP and ΔH	3,030,000	15.97	.000
	ΔS on ΔNH and ΔH	2,600,000	13.51	.000
1981:	ΔS on ΔCD and ΔH	1,700,000	16.59	.000
	ΔS on ΔCC and ΔH	1,580,000	15.20	.000
	ΔS on ΔPP and ΔH	3,050,000	29.45	.000
	ΔS on ΔNH and ΔH	2,690,000	25.81	.000
1982:	ΔS on ΔPP and ΔH	340,000	1.29	.258
Mean:	ΔS on ΔCD and ΔH	337,616	6.62	.010
	ΔS on ΔCC and ΔH	72,818	1.41	.238
	ΔS on ΔPP and ΔH	615,991	12.38	.000
	ΔS on ΔNH and ΔH	454,913	8.86	.003

on equity *and* ΔH. The R^2 values and F-ratios in Table 8 are the same as those presented in Table 5, since the same combinations of FAS 33 and historical cost variables are used in both sets of multiple regressions. A comparison of the r^2 values from Table 7 to the R^2 values from Table 8 indicates that the coefficient of determination increases by including ΔH in the regression for all FAS 33 variables in 1980, 1981, and the three-year analysis. The only increase in the coefficients of determination for 1982, however, occurs when purchasing power returns are added as the independent variable in the regression equation.

Table 9 presents the difference in the sums of squared errors for all instances where the R^2 value from Table 8 exceeds the compared r^2 value from Table 7. In addition, the F-ratio and significance of the tests for the incremental information content of historical cost data are displayed.

The tests of the ability of historical cost returns to add to the explanatory power of constant dollar data yield inconsistent results. While the test for incremental information content is extremely significant in 1981 and the three-year analysis, it is not significant in 1980 or 1982. However, the tests reveal that we can be 99.0 percent confident, over the three-year period, that historical cost returns on equity possess incremental information content beyond that provided by constant dollar returns on equity.

Tests of the ability of historical cost returns to add to the explanatory power of current cost data in explaining security returns yield significant results only in 1981. Results for 1980, 1982, and the three-year period are not significant. Even though the 1981 results are extremely significant, they cannot be generalized. Historical cost returns on equity, therefore, are not found to possess incremental information content beyond that provided by current cost returns on equity.

Historical cost returns on equity do add significantly to the ability of purchasing power returns on equity to explain security returns in both 1980 and 1981 and for the three-year analysis. Although the coefficient of determination increases from the addition of the historical cost returns in 1982, the increase is not significant. The ability of historical cost returns to add to the explanatory power of FAS 33 variables is strongest in the case of purchasing power returns. Recall from the tests of H_1 that purchasing power returns provided the strongest evidence for the incremental information content of any FAS 33 variable. It appears that the information content in each of these two variables (historical cost and purchasing power returns) is complementary to one another in that they explain different effects on security prices. The relatively low and negative correlations between these two variables presented in Table 3 tend to support this supposition.

Tests of the ability of historical cost returns to add to the information content of net holding returns on equity produce significant results for 1980, 1981, and the three year analysis. Only in 1982 is the coefficient of determination not increased by the addition of the historical cost returns in the regression. Historical cost returns on equity, therefore, do add to the explanatory power of net holding returns on equity.

To summarize the four tests of H_2, historical cost returns on equity do possess information content beyond that provided by constant dollar, purchasing power, and net holding returns. Historical cost returns fail to demonstrate incremental information content relative to current cost returns on equity.

EFFECTS OF FAS 82

In November 1984, the FASB issued Statement of Financial Accounting Standards No. 82 (FAS 82) which supersedes some portions and amends other portions of FAS 33. The major effect of FAS 82 is to eliminate the requirement for disclosure of constant dollar information for firms that report current cost/constant purchasing power data. That is, disclosure of income from continuing operations, income per share, and net assets on an historical cost/constant dollar basis is no longer required for firms that report current cost data adjusted for the effects of changes in the purchasing power of the monetary unit. Disclosure of purchasing power and net holding gains and losses is still required.

The term *constant dollar* has been accepted as an abbreviated way of referring to the historical cost model when expressed in terms of general purchasing power units. Indeed, the term has been used herein in this sense. *Constant dollar*, however, is a misnomer when applied to monetary units other than the dollar. The term *constant purchasing power* is used in FAS 82 as a more general term that can be applied to any monetary unit (such as English pounds or French francs).

The FASB's issuance of FAS 82 integrates the two different approaches to dealing with the problem of changing prices. Current cost accounting is an attempt to deal with problems created by changes in specific prices, while historical cost/constant purchasing power (heretofore referred to as constant dollar) accounting is an attempt to deal with problems created by changes in the general price level. Current cost/constant purchasing power accounting is considered by many [Sterling, 1975; Chambers, 1975; and Belkaoui, 1981, for example] to be theoretically superior to either current cost or historical cost/constant purchasing power accounting.

Neither the current cost nor constant dollar data investigated herein clearly demonstrated incremental information content. The changes required by FAS 82 suggest that the Financial Accounting Standards Board (FASB) believes the current cost/constant purchasing power disclosures will be more useful. These disclosures, however, will still be supplementary. The more prominent and comprehensive presentation of historical information gives the historical cost model an unfair advantage in any comparison of the usefulness of the different alternatives. While the changes brought about by FAS 82 will facilitate the evaluation of the current cost/constant purchasing power model, FAS 82 does nothing to change the advantage favoring historical cost data in future empirical tests.

SUMMARY AND DISCUSSION

This research examines the information content of FAS 33 and historical cost data. Initially, the ability of FAS 33 data to add to the explanatory power of historical cost data is tested. Subsequently, the incremental information content of historical cost data is tested. Data for 1980, 1981, and 1982 are analyzed. A matched-pair design is used to control for the effects of cross-sectional correlation on the dependent and independent variables.

Results of this study lead to the following conclusions:

1. Purchasing power returns on equity possess incremental information content beyond that provided by historical cost returns on equity in explaining security returns.
2. Current cost and net holding returns on equity do not possess incremental information content beyond that provided by historical cost returns on equity in explaining security returns.
3. Historical cost returns on equity possess incremental information content beyond that provided by constant dollar, purchasing power, and net holding returns on equity in explaining security returns.
4. Historical cost returns on equity do not possess incremental information content beyond that provided by current cost returns on equity in explaining security returns.

These results differ from those obtained by Beaver and Landsman [1983]. They conclude that "Statement 33 earnings provide no explanatory power . . . over and above that provided by historical cost earnings" [p. 73]. Purchasing power returns on equity do demonstrate incremental information content in this research, however. In addition, Beaver and Landsman found the incremental information content of historical cost data to be highly significant in all their tests. This research finds that historical cost returns on equity do not possess information content incremental to current cost returns.

The different results obtained herein may be due to the matched-pair design used to control for the effects of cross-sectional correlation on the security and accounting returns. Beaver and Landsman acknowledge that their significance levels may be overstated because of their lack of control for cross-sectional correlation [p. 63].

Alternatively, these different results may be caused by different significance tests. Beaver and Landsman rely on *t*-values to test the significance of the coefficients of the FAS 33 and historical cost independent variables in their regressions. This research focuses on the significance of the reductions in the sums of squared errors created by including additional FAS 33 and historical cost variables in the regression equations.

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The Merger/Bankruptcy Alternative

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ABSTRACT: Considerable research has examined the ability of accounting information to predict bankruptcy. Bankruptcy, however, represents only one of many possible outcomes for the distressed firm. A timely merger can serve as a bankruptcy alternative. The study compares a sample of distressed firms that merged to a sample of distressed firms that entered bankruptcy. Theory suggests that the owners of distressed firms should prefer merger. The managers, however, may feel that their interests are better served through bankruptcy. The examination focuses upon both firm-related characteristics and the personal interests of owners as determinants of the merger/bankruptcy choice. A probit analysis was used to test the importance of three firm-related variables—revenues, financial leverage, and the magnitude of tax carryforwards in explaining the merger/bankruptcy decision. The examination shows that the distressed firms that merge have lower financial leverage and are larger than firms that enter bankruptcy. Tax carryforwards are not important in the model. We also examined the association of ownership concentration with the merger/bankruptcy choice. The tests reveal that distressed firms with high ownership concentration (or owner control) show an increased tendency to merge rather than to declare bankruptcy. The results suggest that the self-interest of managers, rather than just the interests of shareholders and creditors, seems to help motivate the merger/bankruptcy choice.

The association of accounting relationships and financial distress has been examined extensively in the accounting literature. Early studies including Beaver [1967], Altman [1968], and Deakin [1972] examined the ability of accounting ratios to identify the financially distressed firm. A closely related line of research has examined alternatives to bankruptcy, including the merger alternative. Altman [1971] and Stiglitz [1972], among others, have noted the use of mergers as substitutes for bankruptcy. More recently, Bulow and Shoven [1978] and Shrieves and Stevens [1979] have examined the timely decision to merge as a bankruptcy alternative. This paper seeks to integrate the previous research by examining the extent to which accounting information seems to explain the merger/bankruptcy decision.

THE ALTERNATIVES

A number of alternatives are available to managers of firms in financial difficulty. These alternatives include:

- Bankruptcy with the possibility of business termination;
- Continued operation in expectation of future solvency, perhaps in conjunction with restructuring debt, re-

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ducing wages, selling productive assets, or anticipating improvement in general economic conditions; and
- Participation in a merger or other form of acquisition.

The concern here is with the two extreme alternatives—bankruptcy and merger. The merger and bankruptcy alternatives lead to very different implications for the shareholders, creditors, and management of the distressed firm. The alternatives also have important social consequences in that they affect customers, suppliers, the community, and other outside parties.

The next section of the paper examines the impact of the bankruptcy and merger alternatives upon the firm. Following this is an examination of influences on management's choice of the merger/bankruptcy alternatives. We then report on an empirical study of conditions under which management seems to opt for merger as an alternative to bankruptcy.

Bankruptcy

The term bankruptcy refers to a variety of circumstances. One is the condition of negative net worth—where the market value of assets is less than total liabilities. Another is the inability to pay debts as they come due. The term bankruptcy also applies to a legal condition under which a firm continues to operate under court protection. The legal definition is the one adopted for use in this study.

Bankruptcy has multiple objectives. One objective is to protect the rights of creditors. A second objective is to provide time for the distressed business to improve its situation. Bankruptcy prevents creditors from taking additional action to collect on debts or to foreclose on property. A third objective in extreme cases is to provide for the orderly liquidation of assets.

Bankruptcy can be initiated either by the firm or its creditors. Creditors, for example, can petition for bankruptcy on showing that the corporation is not paying its bills. In a bankruptcy the court may appoint an independent trustee to manage the firm's property or may permit the previous management to continue operating the business. The concerned parties then make recommendations for business operations or for the distribution of assets.

The Merger Alternative

There are numerous motivations for merger including growth, synergy, diversification, and control objectives [Halpern, 1983]. With respect to the distressed business merger, the merger of a distressed and a healthy business provides the distressed business with a source of capital and consequently permits continuation in business with less risk of failure.

The literature suggests that generally the distressed firm's shareholders should benefit more from merger than from bankruptcy. The shareholders continue to hold stock with some positive value as a result of the merger. In contrast, the shareholders often receive nothing in a bankruptcy.[1] Shrieves and Stevens [1979] set forth a number of possible reasons for preferring merger over bankruptcy. These include:

- Avoidance of bankruptcy legal and administrative costs;
- Possible loss of tax carryforwards of the loss firm on liquidation (examined later);
- Going-concern value in a merger greater than liquidation value if the bankruptcy progresses to liquidation; and
- Adverse effects of bankruptcy on sales and income due to customer

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[1] Clark and Weinstein [1983] report that the stock value declined to zero for 66 of the 162 bankrupt firms examined in their study.

> fears of inability to honor contracts, provide replacement parts, etc.

Bulow and Shoven [1978] demonstrate that avoiding bankruptcy should always benefit creditors as a whole and that in theory, bankruptcy occurs only because of disagreement between the concerned parties. The literature treats merger as a substitute for bankruptcy under the presumption that the distressed firm should be able to find a merger partner at some price as long as the net asset value is positive and under the assumption of a well-functioning market for information. As the situation deteriorates toward a condition of negative net asset value, the possibility of merger is reduced.

In theory, we might expect the distressed firm to take the initiative in trying to arrange a merger. Empirically, however, this is difficult to test.[2] For example, a possible scenario might involve the distressed firm's quietly mentioning its availability to its bankers with no public announcement. Some time later, a potential acquiring firm formally and publicly demonstrates interest in an acquisition. In this case, the newspaper announcements would not accurately reflect which party initiated the acquisition. This study is concerned with the conditions under which merger seems to be an attractive alternative to bankruptcy, and with management's incentives to merge rather than declare bankruptcy. The interest is limited to whether or not the distressed firm merges and the issue of determining which firm initiates the merger is not addressed.

Merger seems preferred to bankruptcy from the shareholder's view. Even if the discontinuance of operations is contemplated, the ability of the acquiring corporation to benefit from tax loss carryforwards should result in more value in a merger than in a sale of assets in liquidation. When the interests of managers are considered, however, the situation changes. The next section illustrates that while merger may be beneficial to the equity shareholders, the distressed firm's managers may not view a merger as desirable.

INFLUENCES ON MANAGEMENT CHOICE

This study examines management's merger/bankruptcy decision as a joint function of the characteristics of the distressed firm's ownership and of the distressed firm itself. The expected relationship of ownership in the distressed firm and the merger/bankruptcy choice is examined in the following section. We then examine firm-related characteristics.

Management's Interests

Although merger of the distressed firm should best serve unsecured creditors and shareholders, top managers may feel that their interests are better served through bankruptcy. Jensen and Ruback [1983, p. 31] assert that "since target managers replaced after takeovers lose power, prestige and the value of organization-specific human capital, they have incentives to oppose a takeover bid even though shareholders might benefit substantially from acquisition." Similarly, Baron [1983] suggests that management may resist tender offers because of their "preference for control" to preserve jobs, perquisites, and any agency costs they are appropriating. The results of an empirical study by

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[2] We examined *Wall Street Journal* articles published for the year prior to the bankruptcy announcement to obtain insights regarding merger negotiations. Analysis of the bankrupt firms included in our sample revealed evidence of prior merger negotiations in only 15 percent of the cases. The newspaper articles did not indicate which party actually initiated the merger proposal. We have no indication of the number of unreported negotiations or whether the reported negotiations were meaningful. We also searched for announcements of merger negotiations for the merger firms. These announcements did not usually indicate which party initiated the proposal.

Ang and Chua [1981] suggest that managers of acquired firms may lose jobs more rapidly than managers of firms that go bankrupt and successfully emerge from bankruptcy. Corporations sometimes emerge from bankruptcy with the same managers. If the distressed firm's management optimistically anticipates this outcome, management may prefer bankruptcy to merger.

When the firm is controlled by equity shareholders rather than by managers, we expect that the shareholder interests will prevail. Previous work by Williamson [1964] and Monsen and Downs [1965], among others, suggests an association between ownership concentration and management decisions. With respect to the merger/bankruptcy choice, shareholders should prefer merger to bankruptcy because in a merger the equity shareholders receive stock while in bankruptcy they frequently end up with nothing. Jensen and Ruback [1983], in a review of previous studies, note that in tests including both healthy and distressed firms, target firms in successful takeovers experience abnormal stock price increases of 20 percent. Clark and Weinstein [1983], in an examination of distressed firms, report that stock prices decrease substantially when troubled firms file for bankruptcy. They find that this stock price reduction is in addition to previous stock price reductions associated with market awareness of financial distress.

The preceding discussion suggests that the extent of ownership concentration should influence the merger/bankruptcy choice. If ownership is concentrated among a few shareholders, these shareholders will tend to exercise control. An associated possibility is that high management stock ownership is partly responsible for the high owner concentration and that in this case, the interests of managers and shareholders will be more congruent. In either case we expect that distressed corporations with large ownership concentration ratios will merge rather than declare bankruptcy. On the other hand, if ownership is not concentrated, we expect managers to exercise more control and act in their own interest rather than in the interest of owners. In this event, managers may opt for bankruptcy.[3]

Ownership concentration information is published in a number of sources including proxy statements provided in accord with Securities and Exchange Commission (SEC) Rule 403 and SEC 10-K Statements. For purposes of this study we used a secondary data source, the Standard and Poor's *Corporate Records*. The *Corporate Records* contain financial information including ownership data on most larger publicly held firms. Use of this source resulted in a substantially larger sample than would be possible through relying on proxy statements, which are not readily available for the 1970s.

Ownership concentration is measured as the total percentage of voting stock owned by managers, directors, and other parties. This concentration measure is similar to that used by Dhaliwal, Salamon and Smith [1982] in a study of control and accounting methods. The measure used here differs primarily in that concentration is measured continuously rather than as a dichotomous variable. A high concentration ratio implies owner rather than manager control of the business and is expected to be associated with the merger option. Low concentration implies a high degree of management control and should be associated with the bankruptcy alternative.

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[3] Conceivably a manager can invest a high percentage of individual wealth in the firm's shares while the manager's stock ownership as a percentage of total shares outstanding still remains relatively low. In this case, the manager's preferences might resemble those of shareholders, even though the observed concentration ratio is low. It seems more likely to us, however, for a low relative concentration measure to be associated with a low relative importance of ownership to the manager. In other words, we assume that low ownership concentration, in general, implies small amounts of management stock ownership.

As an alternative, we could have examined the percentage or value of stock owned by managers. The concentration measure was used because it seems to better represent control and because we could not always determine the effective management stock ownership. In some cases, the disclosures indicated only the total percentage ownership of both managers and directors. In other cases, individuals with the same family names as the managers owned stock, or trusts owned large percentages of stock with managers voting these shares. Use of the concentration measure avoided arbitrary determinations in these cases.

Firm-Related Variables

A number of firm-related variables also are expected to be associated with the merger/bankruptcy alternative. These include financial leverage, the availability of tax carryforwards, the size of the firm and the severity of financial distress. The study examines these variables in evaluating the association of ownership concentration and the merger/bankruptcy decision.

Financial Leverage. Other things equal, we expect that highly leveraged firms should make less desirable acquisition candidates. One reason is that if a low-leverage firm acquires a high-leverage firm, the leverage of the new firm will be higher than for the original firm and the borrowing capacity will be reduced. While one might argue that the buyer can take debt into consideration in determining the offering price, it seems more likely that potential buyers will avoid the highly leveraged firm. Empirical support is provided by Stevens [1973], who found that acquired firms were significantly less leveraged than nonacquired firms. Other factors equal, with higher leverage, the distressed firm's shareholders' interests should be advanced more through merger than through bankruptcy. Our expectation, however, is that the dominant factor will be the reduced demand for highly leveraged acquisitions. Consequently, we expect that high leverage will be associated with bankruptcy rather than merger. Leverage is measured here as the ratio of total debt to total assets.

Tax Carryforwards. Many firms in financial distress possess operating loss carryforwards. Tax legislation provides for the carryback of operating losses against taxable income of the three previous years. When tax losses exceed available carryback eligibility, the business obtains carryforward entitlement. The carryforward entitlement reduces taxable income in future profitable years. Currently the legislation prescribes a 15-year carryforward period for operating losses.

Potentially valuable carryforwards also arise from unused investment tax credits. The investment tax credit reduces taxes payable by ten percent of the cost of qualifying investments in most personal property. Since the zero income corporation will likely not pay taxes, the investment tax credit will not provide immediate tax benefit. The legislation also provides for the carryforward of unused investment tax credits.

Carryforwards are of interest to the merger/bankruptcy decision because they have value only if the firm remains in business. If the firm terminates operations, the carryforwards are lost. On the other hand, if the financially distressed business is acquired it may be possible to retain the carryforwards. (The business press frequently cites tax carryforwards as rationale for an acquisition.) Consequently, we expect that financially distressed firms with loss carryover eligibility will tend to merge rather than enter bankruptcy. The carryforward variable is measured as the amount of the carryforward (including investment tax credit carryforward) as a percentage of total revenues. Measurement of the carryforward relative to the size of the firm provides an indication of the relative importance of the carryforward compared to other considerations. If carryforwards provide incentives for merger rather than bankruptcy, we expect carryforwards to be positively correlated with merger.

Total Revenues. We also test for the effect of size because large firms and small firms differ in many respects and size empirically explains differences in many previous accounting studies. Collins, Rozeff and Dhaliwal [1981], for example, suggest that size is an all-inclusive variable that can act as a surrogate for the many variables not specifically included in the study. The direction of the possible association of size and the merger/bankruptcy choice is not clear. Size is measured here as the natural logarithm of total revenue adjusted for changes in the Consumer Price Index. The indexing reduces possible distortions resulting from examining events occurring up to 14 years apart. No direction is hypothesized for the influence of this variable.

The Severity of Financial Distress. The relative severity of financial distress is expected to affect both the attractiveness of the firm as a merger candidate and management's incentive to merge. The literature generally assumes that merger is an alternative to bankruptcy for the distressed firm or at least for firms in the early stages of financial distress. We expect that increased distress will increase the desirability of merger for the distressed firm and at the same time, decrease its attractiveness as a potential merger partner. In the extreme case of negative net market value, it should be difficult for the distressed firm to obtain a merger partner at any price. While our expectation is that financial distress will be associated with bankruptcy rather than with merger, the interest is in testing for the importance of distress differences in our study design rather than in including distress as an explanatory factor in a model.

Firms classified as financially distressed vary greatly with respect to the degree of financial distress. In some cases the issue of whether or not a firm is distressed and the nature of the distress is not very clear. For example, a reasonably healthy firm may appear distressed due to temporary factors. In other cases, the severity of the situation will be obvious to most observers and the firm will likely have difficulty finding a merger candidate (unless substantial tax carryforwards are available). We expect, other factors equal, that the greater the financial distress, the greater the probability of bankruptcy rather than merger.

Ideally, for the purpose of attributing causality to the ownership concentration variable, the degree of financial distress for the period prior to the bankruptcy or merger event should be the same for the bankruptcy and merger samples. Although the sample selection procedure does not expressly control for financial distress, the study design does test for significant differences in financial distress between the merger and bankruptcy firms.

Financially distressed merger firms are identified using the model developed by Altman [1968].[4] Altman used multiple discriminant analysis to classify firms as bankrupt and nonbankrupt using the following relationship:

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[4] We selected the Altman [1968] model because the data were readily available, it is relatively easy to use, it seems to be reasonably well understood and, applied on an ex-ante basis, it may work as well as other models proposed to date. Some alternatives such as the Altman, Haldeman and Narayanan [1977] Zeta procedure are more subjective and would have increased study complexity since the model was used to select distressed merger firms from the entire Compustat population.

$$z_j = 1.2*X1_j + 1.4*X2_j + 3.3*X3_j + 0.6*X4_j + 1.0*X5_j,$$

where

j is the firm index,
$X1_j$ is working capital/total assets,
$X2_j$ is retained earnings/total assets,
$X3_j$ is earnings before interest and tax/total assets,
$X4_j$ is market value of equity/book value of total debt, and
$X5_j$ is sales/total assets.

The value of the dependent variable, z_j, is compared to the critical cutoff value to identify the bankrupt and nonbankrupt firms. The model incorporates financial relationships for the time period immediately preceding the date of filing for bankruptcy. The discriminant analysis then produces a cutoff or z-score to differentiate between firms filing for bankrupt and nonbankrupt firms. Altman's critical or cutoff z-score was 2.675 with lower z-scores indicating financial distress. A number of subsequent empirical studies have confirmed the success of this model. The present study applies the Altman model and cutoff scores to obtain a z-score for each firm included in the sample.

We expect to find a positive association between financial leverage and financial distress and do not include financial distress in the multivariate model for this reason. We should note that leverage and distress do not necessarily measure the same phenomenon. Financial distress as indicated by the z-score considers profitability and a number of other factors in addition to leverage.

THE SAMPLE

A sample of troubled firms was obtained for the 14-year period beginning in 1970 and ending in 1983. The Bankruptcy Reform Act of 1978 significantly modified the ability of firms to reorganize in bankruptcy [White, 1983; Altman, 1983], and we were initially reluctant to go beyond the 1979 effective date of the Act. The sample size using just pre-1979 data, however, proved to be smaller than expected. To expand the sample we conducted the study first using the entire sample and then using just the pre-1979 data.

The sample of firms was obtained from the 1983 Compustat Annual Industrial Research Tape. This tape shows all firms deleted from Compustat with financial data up to one or two years prior to the year of deletion. The sample of distressed firms was selected using the model developed by Altman [1968]. Previous examinations of this model have indicated high predictive ability for control group firms not included in the sample used to obtain the discriminant function. There are also indications that the model is robust over time. Altman and McGough [1974], for example, examined periods subsequent to that tested in Altman [1968] and concluded that the parameters of the model classified cases with a high degree of accuracy in these later time periods. Consequently, the present study identifies troubled merged firms using the Altman discriminant function parameters and critical cutoff described earlier.

We restricted the sample to manufacturing firms since the Altman model was not developed for banks, insurance companies, or other nonmanufacturing businesses. The Research Tape contains 531 manufacturing firms that merged during the study period. The Altman model was then run on each firm for the last year of data availability. The z-scores suggest that 83 manufacturing firms were distressed. Of these, 15 were not publicly traded, were not listed in Standard and Poor's *Corporate Records*, were missing key Compustat data for several years prior to the merger date, or were operated as subsidiaries and merged through long-

TABLE 1

SUMMARY STATISTICS FOR INDEPENDENT VARIABLES

Variable	*Merged Firms* *Mean*	*Merged Firms* *Standard Deviation*	*Bankrupt Firms* *Mean*	*Bankrupt Firms* *Standard Deviation*
Concentration	0.333	0.226	0.271	0.211
Leverage	0.386	0.163	0.525	0.187
Tax	0.107	0.291	0.116	0.142
Log Size	3.802	1.294	2.690	1.066
Distress	1.980	0.657	1.650	1.478

term creeping acquisition. A sample of 68 distressed manufacturing firms that merged remained for study.

The Compustat research tape includes 95 bankrupt firms, of which 56 are manufacturing firms. Fourteen firms were deleted for data availability reasons, and 42 firms remained for study. (The Altman model classified 33 of these 42 firms as bankrupt as of the latest annual financial data available prior to bankruptcy.) The final sample contains 110 distressed firms that either merged or entered bankruptcy.

The ownership concentration and tax carryforward data were obtained from Standard and Poor's *Corporate Records* using information for the reporting period just prior to the announcement of bankruptcy or merger. All other financial data were taken from Compustat using the most recent financial information available on the bankruptcy or merger announcement date.

THE DISTRIBUTION OF INDEPENDENT VARIABLES

The summary statistics for the independent variables are presented in Table 1. The data show that ownership concentration is substantially higher for merged firms. This is consistent with the hypothesis that firms with low ownership concentration (manager control firms) tend to act in the interest of managers and choose bankruptcy rather than merger. The summary statistics also indicate that distressed firms entering bankruptcy are more highly leveraged, are smaller, have slightly larger tax carryovers, and have somewhat lower Altman z-scores (indicating high financial distress) compared to the merged firms. We consider these relationships in more depth in the following multivariate analysis.

MULTIVARIATE ANALYSIS

We first present data relating to the correlations between independent variables. We then introduce the probit model, present results, and test the predictive ability of the variables.

Cross-Correlations

The degree of cross-correlation between independent variables is summarized in Table 2. Correlation coefficients are relatively low except for the leverage/financial distress relationship. The leverage/financial distress relationship is consistent with the expectation that high z-score (low distress) firms should have less debt. The high correlation was responsible for excluding the distress variable from the probit model.

TABLE 2

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	Concentration	*Leverage*	*Tax Carryforward*	*Size*	*Distress*
Concentration	1.000	−0.006	−0.123	−0.148	0.134
Leverage		1.000	0.135	−0.192	−0.425
Tax Carryforward			1.000	0.006	−0.190
Size				1.000	0.142
Distress					1.000

Probit Analysis

The joint ability of the independent variables to explain the merger/bankruptcy choice was examined using both probit analysis and multiple discriminant analysis. Multiple regression analysis requires a dependent variable with an interval scale—an assumption not met with the merger/bankruptcy measure. Probit analysis is less restrictive in that it assigns a distribution to the dependent variable under the assumption that the underlying distribution is approximately normal. An advantage of probit over multiple discriminant analysis is that it provides significance tests for the individual independent variables as well as for the overall classification. Kaplan and Urwitz [1979] and Hagerman and Zmijewski [1979] provide more detailed comparisons of alternative models.

The form of the classification model is:

$$M_j = a + b1 * \mathrm{CON}_j + b2 * \mathrm{LEV}_j + b3 * \mathrm{TAX}_j + b4 * \mathrm{SIZE}_j + e_j.$$

where

j is the firm index,

M_j is 0 if the result is bankruptcy; 1 if a merger,

CON_j is the percentage of outstanding shares owned by major shareholders as reported in Standard and Poor's *Corporate Records*,

LEV_j is the ratio of total debt to total equity,

TAX_j is the ratio of available tax loss carryforwards (including investment tax credit carryforwards) to total revenues, and

SIZE_j is the natural logarithm of total revenue adjusted for changes in the Consumer Price Index.

The intercept a and the terms $b1$ through $b4$ are coefficients obtained by fitting the model, and e_j is the unexplained error term.

The probit model results are presented in Table 3. The percentage of variance explained (adjusted R^2 statistic) by the model is 53.2 percent. The model correctly classifies 73.6 percent of the cases. The accuracy of the probit model classification was compared to the accuracy of the best naive model using a standard test of proportions. This test reveals that the classification results are significant at the 0.01 level. The chi-square statistic of 40.9 with four degrees of freedom is significant at the 0.01 level.

The analysis of each independent variable as summarized in Table 3 indicates that ownership concentration, financial leverage, and size are all significant at the 0.01 level. The tax carryover variable does not exert any important influence

TABLE 3

PROBIT ANALYSIS OF MERGER/BANKRUPTCY CHOICE MODEL

Adjusted R^2	53.2 percent
Percent of cases predicted correctly	73.6 percent
Chi-square statistic (4 d.f.)	40.9 (.01 significance)

Independent variables	*CON*	*LEV*	*TAX*	*SIZE*
Expected sign of independent variables	POS	NEG	POS	—
Maximum likelihood estimate	1.671	−3.036	0.861	0.619
t-statistic	2.396	−3.400	0.830	4.064
Significance level	.01	.01	.40	.01

upon the ability to explain the merger/bankruptcy choice after the effects of ownership concentration, financial leverage, and size are considered.

We note that the results may understate the role of financial leverage since leverage is one variable used in the Altman model to select the sample of merged firms. We expect that the merger sample used here will tend to have high-leverage firms and since we also expect high leverage for bankruptcy firms, the ability of financial leverage to explain the merger/bankruptcy choice may be greater than that indicated by this model.

With respect to the owner concentration variable, the probit model results differ from those suggested in Table 1. The Table 1 data do not suggest substantial differences between ownership concentration for the merger and bankruptcy samples. The probit analysis, however, shows that after adjusting for the effects of leverage and size, concentration adds to the ability of the model to explain the merger/bankruptcy choice.

The univariate examination showed that the merger and bankrupt firms have slightly different distress measures and consequently did not seem to be in identical circumstances just prior to bankruptcy. As indicated previously, financial distress was not included in the multivariate model due to high correlation with the financial leverage variable. We repeated the probit analysis with the distress variable included and obtained very similar results to those reported in Table 3. These findings suggest that the observed differences in distress measures between the two samples were not responsible for the study results.

The data seem to demonstrate that owner-controlled and manager-controlled firms act differently. Previous research showed the relationship between ownership control and the choice of accounting alternatives. The present study suggests that ownership control is also associated with merger/bankruptcy choice. Since owner and manager control firms seem to make different economic decisions, ownership structure should be important to investors, lenders, and other financial statement users. Consequently, the results seem to support the SEC proxy statement

TABLE 4
DISTRIBUTION OF SAMPLE BY YEAR

Year	*Number of Merged Firms*	*Number of Bankrupt Firms*
1970	0	2
1971	5	1
1972	3	3
1973	3	3
1974	2	3
1975	2	3
1976	6	6
1977	7	2
1978	8	6
Subtotal	36	29
1979	15	2
1980	1	4
1981	9	1
1982	3	4
1983	4	2
Subtotal	32	13
Total sample	68	42

requirements for ownership concentration disclosure.

The 1978 Bankruptcy Act

The 1978 Bankruptcy Act, as indicated earlier, substantially changed bankruptcy procedures and may have influenced the merger/bankruptcy decision. The analysis so far has considered the entire sample including both the pre-1979 and post-1979 periods (see the distribution of events by year shown in Table 4). To examine the possible influence of the 1978 Act upon study results, we repeated the analysis using only pre-1979 data. The sample size was reduced to 65 firms.

The distribution of independent variables was similar to that reported in Table 1 for the complete sample. The probit model classification, however, is even more powerful than with the larger sample. The percentage of variance explained by the probit model increases to 74.3 percent from 53.2 percent for the full sample, and the percent of cases predicted correctly increases to 83 percent from 73.6 percent. The apparent ability of the model to fit the pre-1979 period better (than for the entire observation period) may be due to a variety of factors including the effect of the new legislation.

Discriminant Analysis

As a consistency check, we conducted a multiple discriminant analysis to test the predictive power of the variables considered in the merger/bankruptcy choice. First we discuss the ability of the model to classify observations. The results summarized in Table 5 reveal that for the full sample of firms, the discriminant function correctly classified 86.8 percent of the mergers and 57.1 percent of the bankruptcies for an overall classification rate

TABLE 5

MULTIPLE DISCRIMINANT ANALYSIS OF MERGER BANKRUPTCY CHOICE MODEL

Standard Multiple Discriminant Analysis:

		Classification	
Group	*Percent Correct*	*Merger*	*Bankrupt*
Merger	86.8	59	9
Bankrupt	57.1	18	24
Total	—	77	33
Average	75.5	—	—

Lachenbruch Holdout Sample Technique:

		Classification	
Group	*Percent Correct*	*Merger*	*Bankrupt*
Merger	80.9	55	13
Bankrupt	54.8	19	23
Total	—	74	36
Average	70.9	—	—

of 75.5 percent. For the reduced sample of 65 pre-1979 firms, the classification rates for mergers, bankruptcies, and combined sample were 72.2 percent, 82.8 percent, and 76.9 percent, respectively. The difference in classification accuracy for the merger and bankruptcy groups is due at least in part to statistical properties of the classification model. Analysis of correct cases requires priors regarding the expected distribution. With unequal probabilities, the model assigns proportionately more observations to the larger group [Pinches, 1980].

The Lachenbruch jackknife holdout sample procedure then was applied to test the predictive accuracy of the discriminant function. The jackknife technique avoids the problem of testing the model on the same data used to fit the model. It is also distribution-free and does not require multivariate normality, equal dispersion matrices, and other restrictive assumptions of multiple discriminant analysis. This approach correctly predicted 80.9 percent of the mergers and 54.8 percent of the bankruptcies for an overall prediction rate of 70.9 percent. An overall prediction accuracy of 76.9 was achieved when the discriminant function was developed using only pre-1979 data. The results of the jackknife model predictions exceeded those achieved by the best naive model at the 0.01 significance level.

SUMMARY AND CONCLUSIONS

Numerous corporate bankruptcies occur every year despite the apparent attractiveness of merger as a possible alternative to bankruptcy for some distressed firms. This study examined factors associated with the merger/bankruptcy choice. Analysis of the literature suggested that variables to be considered include ownership concentration, financial leverage, tax carryovers, and size. The results show that size, leverage, and ownership concentration dominate the explanatory model. The tax carryover variable was not significant.

The results are consistent with the hypothesis that the self-interest of managers seems to be at least partly responsible for the merger/bankruptcy choice. Previous research by Dhaliwal, Salamon and Smith [1982] revealed the importance of ownership control as a determinant of accounting method choice. This study suggests that ownership control is also associated with the merger/bankruptcy alternative. One potentially important accounting implication is that proxy disclosure of ownership concentration appears to be potentially useful to investors for providing a basis for predicting future management behavior.

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NOTES

The Effect of Task Predictability and Prior Probability Disclosure on Judgment Quality and Confidence

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ABSTRACT: Seventy-one second-year MBA students participated in a computer-based laboratory experiment involving bankruptcy prediction. The study tested for main and interaction effects of variation in task predictability and disclosure of the prior probability of bankruptcy on subjects' predictive accuracy and related confidence levels. As hypothesized, task predictability was significantly and positively related to predictive accuracy. The main effect of disclosure of the prior probability of bankruptcy was not significant, but its interaction effect with task predictability was significant when accuracy rates for bankrupt and nonbankrupt firms were analyzed separately. In particular, disclosure of the prior probability to subjects in the low task predictability condition resulted in a significant improvement in their predictive accuracy. Subjects in all treatment groups were overconfident about their predictive accuracy, with subjects in the low task predictability condition significantly more overconfident than subjects in the high task predictability condition.

RECENT research in cognitive psychology and accounting [Einhorn and Hogarth, 1981; Libby and Lewis, 1982; Hammond, 1982] has re-emphasized the need to examine the possible effects of variation in task properties on subjects' performance. Specification of task conditions has long been recognized as a prerequisite for the development of a theory of cognition [Tolman and Brunswik, 1935; Simon, 1975]. Hammond [1982] states that it is unknown "how many generalizations . . . will collapse under simple changes in task conditions."

The present study examines the effects of variation in task predictability and the disclosure of prior probabilities on subjects' predictive accuracy of bankruptcy and their related confidence level. Task predictability, in a general sense, characterizes the usefulness of information cues for predicting task outcomes.[1] More specifically in the present study, task predictability means the ability of financial

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[1] The terms "data diagnosticity," "statistical information content," and "ecological validity" have been used in various studies to represent the information attribute that we and others refer to as task predictability. It should be noted, however, that this information property is not independent of the statistical classificatory models employed.

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accounting cues to predict corporate bankruptcy when they are used as inputs to statistical prediction models. Accounting cues that predict with a high (low) level of accuracy are said to have high (low) task predictability. Task predictability and the disclosure of prior probabilities are each a salient task property whose manipulation has been hypothesized by accounting researchers and others to have the potential for affecting judgment quality.

The selection of task predictability and prior probability disclosure was also motivated by reasons of more direct concern to accounting. Task predictability is studied for two such reasons. First, task predictability is arguably the most important attribute of accounting information systems, yet it has been the subject of only a limited amount of study by accounting researchers.[2] Second, variation in the level of task predictability has been hypothesized explicitly as a likely cause of conflicting findings among previous accounting studies of subjects' bankruptcy predictions [Casey, 1983].

Prior probability disclosure is studied because the findings of previous related accounting research [Libby, 1975; Abdel-khalik and El-Sheshai, 1980; Casey, 1983; Johnson, 1983; Houghton, 1984] are inconsistent and the treatment of this factor in real-world information systems has the potential for significant economic effects. Also, an interaction effect between task predictability and prior probability disclosure has been hypothesized to affect subjects' judgment quality [Johnson, 1983].

PRIOR RESEARCH

Task Predictability

Early "lens model" research [Hursch, Hammond, and Hursch, 1964; Tucker, 1964] established the importance of task predictability to subjects' ability to make accurate predictions. Specifically, task predictability has been shown analytically to set an upper limit on subjects' predictive accuracy [Hammond and Summers, 1972]. Brehmer [1978] notes in his review of a wide variety of judgment tasks that one of the most stable results in judgment research has been the direct relationship between data diagnosticity and judgment consistency.

Ashton [1981] assessed the effect of variation in task predictability on three indices of subjects' ability to process information: acquisition, application, and performance. Subjects in that study were randomly assigned to one of three treatment groups and first exposed to historical pricing decisions and sets of cues that had been used in making those decisions. The three groups differed according to the level of predictability of the pricing decisions based on the various cue sets. Subjects then were asked to make their own pricing decisions using different sets of cues. As hypothesized, all of the performance indices were significantly and positively related to the level of task predictability. The present study extends Ashton's study by employing an accounting task that is financial rather than managerial, and that was more familiar to the subjects, by using different performance measures, and by reflecting a more ecologically representative design [Brunswik, 1956].[3]

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[2] Hammond [1982] reports that 34 percent of the 88 studies in judgment and decision research that he reviewed do not even report the level of task predictability.

[3] To minimize the impact of confounding variables, Ashton [1981] constructed information sets whose average values and standard deviations were held constant across treatment groups. In addition, cue intercorrelations were set equal to zero. The present study did not control for variation in these attributes of task predictability. Ashton's approach has certain advantages relative to ours, one of them being the ability to isolate the sub-property of task predictability responsible for an experimental effect. Nevertheless, Ashton's design also abstracts from the natural habitat of information cues, a central feature of Brunswik's [1956] philosophy and a feature we wanted to retain in the present study.

Prior Probability Disclosure

A large body of research in psychology has explored the degree to which subjects' use of prior probabilities conforms to the normative Bayesian model. Reviews of experimental evidence indicate that subjects incorporate prior probabilities properly in forming judgments of posterior probabilities only under certain conditions [Bar-Hillel and Fischhoff, 1981; Kahneman, et al., 1982]. One of these conditions is when the sample data are viewed by subjects as not fully informative, a condition common to certain accounting contexts. For example, if subjects in a bankruptcy prediction task do not view a firm's specific financial data as providing a clear-cut signal of its financial viability, they would be expected to incorporate available prior probability information together with the firm's financial accounting data into their judgment processes.

A number of accounting studies have examined the impact of prior probability disclosure on subjects' predictions of bankruptcy. The findings of these studies have been inconsistent. Subjects in studies by Libby [1975] and Zimmer [1980] predicted bankruptcy with significantly greater accuracy than did subjects in a study by Casey [1980]. Libby [1981] and Zimmer [1980] attributed this difference to the fact that they had revealed the prior probability of failure to subjects in their studies, whereas Casey had withheld this information.[4]

Casey [1983] conducted a subsequent study in which he assessed the effect of disclosing/withholding the prior probability of failure on loan officers' bankruptcy judgments. He noted that both his study and previous bankruptcy prediction studies had exhibited relatively high levels of task predictability and, therefore, the treatment of the disclosure of prior probabilities should not have been expected to have a significant effect on the subjects' judgments. Consistent with this expectation, there were no significant differences in either subjects' mean predictive accuracy or posterior probabilities. Variation in task predictability was hypothesized to be a more likely cause of the differential performance in the previous studies. This untested hypothesis was based on the observation of a perfect rank-order correlation between subjects' predictive accuracy and the level of task predictability in the various bankruptcy studies cited above.

Abdel-khalik and El-Sheshai [1980] also found that disclosure of the prior probability of failure did not have a significant effect on subjects' predictive accuracy. In contrast, Johnson [1983] discovered that the effect of disclosing the prior probability of failure was contingent upon subjects' perception of the representativeness of the sample data. Johnson's finding is consistent with previous research in psychology, which has found the effect of prior probability disclosure to depend on the informativeness of the sample data.

Houghton [1984] used a within-subjects design to test for an effect of variation in the age of accounting data and the disclosure of the known sample frequency of bankruptcy on loan officers' predictive accuracy of bankruptcy. He found main effects for both independent variables: subjects who used more recent data and those who had been informed of the number of bankrupt firms significantly outperformed subjects who used older data and subjects who were not informed of the frequency of bankruptcy. The effect of disclosing the number of bankruptcies was reported not to be contingent upon the age of the accounting data.

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[4] Actually, Libby [1975] and Zimmer [1980] revealed the known sample frequency of failure, not the prior probability. This distinction is discussed further below.

The present study differs from and extends the research of previous accounting studies on prior probability disclosure in the following ways. First, we explore disclosure of multiple levels of the prior probability of bankruptcy's impact on two dependent variables: subjects' predictive accuracy and their confidence in their predictive accuracy. Second, we decompose the analysis of the effect of variation in the independent variables on overall error rates and confidence levels into Type I and Type II error rates and confidence levels for bankrupt and non-bankrupt firms, respectively. By doing so we are able to discover any significant effects that might have been masked by aggregation. Third, we employ an objective measure of task predictability, the predictive accuracy of bankruptcy, to test for an interaction effect. This difference is significant since subjects' reported perceptions of task predictability may not always be reliable, and collecting data on subjects' perceptions may not always be cost-beneficial.

Fourth, we manipulate prior probabilities. This contrasts with the known sample frequency of bankruptcy that was varied in previous accounting studies [Libby, 1975; Zimmer, 1980; Houghton, 1984]. These two constructs are not the same, and consequently, the choice of priors or base rates as a dependent variable has a potentially significant effect on the findings of this study and previous research. For example, subjects who are told the exact number of bankruptcies in a sample of firms are more likely, *ceteris paribus*, to employ a gaming strategy of counting their number of bankruptcy predictions. Equally important, the findings of accounting studies that have disclosed the known sample frequency of failure cannot validly be compared with the results of research in cognitive psychology on the issue of prior probability disclosure.[5] Fifth, we examine the effect of disclosing biased information on prior probabilities to test whether the effect on subjects' judgment quality is consistent with the direction of the bias.

METHOD

Task

The study was conducted in a personal computer laboratory with participants randomly assigned to one of six experimental treatment groups. The six groups represented two levels of task predictability crossed with three levels of prior probability disclosure (described below). The same written instructions were provided to all subjects. Specific instructions and sample firms' financial data corresponding to the six treatment groups were contained on individualized diskettes distributed to subjects as they entered the laboratory.

The participants were required to make dichotomous predictions of bankrupt/nonbankrupt for each of 30 disguised (15 bankrupt and 15 nonbankrupt), real-life companies and to indicate their confidence level for each prediction. Confidence level was elicited in a manner similar to that used in studies in cognitive psychology [Fischhoff and Slovic, 1980].[6]

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[5] Although the two constructs of probabilities are not the same in the abstract, there exists the possibility that subjects in this and previous bankruptcy prediction experiments made no practical distinction between sample frequencies and prior probabilities. In this regard, there would be no substantive difference between this study and prior research. It should be noted, however, that the difference between the two constructs was emphasized in a required MBA-level course taken by all subjects.

[6] Specifically, subjects were told the following: "Decide what the probability is that your prediction is correct. This probability can be any number from .5 to 1.0. It can be interpreted as your degree of certainty about the correctness of your prediction. For example, if you respond that the probability is 60 percent, it means that you believe that there are about 6 chances out of 10 that your answer is correct. A response of 100 percent means that you are absolutely certain that your answer is correct. A response of 50 percent means that your best

The order of presentation of the sample firms was randomized across and within experimental groups.

Subjects could select as few as one or as many as seven ratios in any sequence they wished for each firm before making their predictions. The seven ratios available for selection were defined in the written instructions. Subjects were required to select the ratios themselves rather than having the ratios provided to them for two reasons: 1) in another study we hope to model more closely subjects' prediction processes using concurrent protocol analysis, and 2) information search is a representative feature of financial analysis [Abdel-khalik and El-Sheshai, 1980].

Subjects were presented first with a series of practice trials whose task predictability and disclosure treatment for prior probabilities were identical to their experimental treatment group.[7] Upon completing the practice trials, subjects made their judgments for the 30 firms. They worked independently and addressed any questions they had concerning the task to the authors, who served as monitors during the experiment. The task appeared to be understandable to the subjects, as only a few such questions were raised. Upon finishing the experimental task, all subjects completed a de-briefing questionnaire. No time limit was imposed and the average time to complete the task was 40 minutes.

Independent Variables

An iterative computer-based algorithm was applied to the financial data of 145 firms that had formed the holdout sample in a previous bankruptcy study [Casey and Bartczak, 1984]. The procedure identified 30 firms (15 bankrupt, 15 nonbankrupt) such that the difference in classification accuracy between the first and the second years prior to bankruptcy was maximized. All 30 firms were accurately classified using financial data one year prior to bankruptcy, and only 53.3 percent (nine of the bankrupt firms and seven of the nonbankrupt firms) of these same firms were classified correctly in the second year prior to bankruptcy. The sample firms spanned a wide range of industrial classifications and sizes.

One-third of the subjects were not informed of the prior probability of bankruptcy; another one-third of the subjects were informed that the prior probability of bankruptcy was 50 percent; and the remaining one-third of the subjects were told that the prior probability of bankruptcy was 35 percent. The manipulation of prior probabilities was made salient to those subjects who received prior probability information through two notices via the computer monitor. The first notice was displayed as a separate frame just prior to the start of the practice trials, and the second notice was displayed in a similar fashion before the start of the main experiment with a highlighted reminder title.

Subjects

Seventy-one second-year MBA students at the Amos Tuck School of Business Administration volunteered to participate in the study. The volunteers' participation was motivated in part by the announcement that prizes would be awarded based on task performance. Twelve prizes were awarded in all: a first-place (dinner gift certificate) and a second-place (hot-tub gift certificate) award for each of the six treatment groups.

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guess is as likely to be right as wrong. No estimate below 50 percent is allowable because you should always be picking the alternative that you think is more likely to be correct."

[7] These practice trials were included among the 30 sample firms used to measure predictive performance as a check on reliability. Reliability coefficients were significant at the .0001 significance level.

TABLE 1

CELL MEANS FOR THE DEPENDENT VARIABLES PREDICTIVE ACCURACY AND ERROR RATES

Disclosure of Prior Probability of Bankruptcy	*Overall Accuracy (%)*		*Error Rates*			
			Non-Bankrupt Firms		*Bankrupt Firms*	
	Task Predictability		*Task Predictability*		*Task Predictability*	
	High	*Low*	*High*	*Low*	*High*	*Low*
No Disclosure of Prior Probability of Bankruptcy	76.1	54.6	17.8	26.7	30.0	64.2
Prior Disclosed to be 50 Percent	73.9	60.6	11.3	32.8	41.0	46.1
Prior Disclosed to be 35 Percent	73.1	56.1	12.8	24.2	41.1	63.6

There was no experimental attrition of subjects, and all subjects requested that they be sent a detailed report of the study's findings upon its completion.

Separate ANOVAs were performed on subjects' number of years of accounting-related work experience and other background variables, as well as the amount of time taken to complete the task. None of these analyses indicated significant differences, providing assurance that the findings reported below were not an artifact of differences among subject groups on variables irrelevant to the focus of the study. The average subject had 1.03 years of accounting-related work experience and had taken 2.65 MBA-level courses in financial accounting and analysis.

RESULTS

Predictive Accuracy

The three models used to measure accuracy in this study are (1) accuracy over all firms, (2) accuracy over the bankrupt firms only, and (3) accuracy over the nonbankrupt firms. Since these three dependent variables may be viewed as a single vector variable and the two independent variables are considered to be class variables, the appropriate starting point for the statistical analysis is MANOVA. When the MANOVA test statistic produces a rejection of the null hypothesis for a main effect or an interaction, inspection of the univariate *F*-ratios via ANOVA designs "may suggest which of the elements of the vector variable are contributing most to the discrimination of the groups, or alternatively, which variates are most affected by the treatments" [Cooley and Lohnes, 1971, p. 230].

As expected, subjects' predictive accuracy was significantly and positively related to task predictability. This result was obtained from the MANOVA (alpha $\geq .0001$) and for each level at which accuracy was measured: 1) all firms and the 2) bankrupt and 3) nonbankrupt groups considered separately. Cell means and the results of the ANOVAs are presented in Tables 1 through 4. The ANOVA tables

TABLE 2
ANOVA FOR OVERALL ACCURACY

Source of Variation	*DF*	*Sum of Squares*	*Mean Square*	*F-Value*	*PR>F*
Treatments	5	5,509	1,101.8	21.77	0.0001
Info. Content	1	5,222		103.16	0.0001
Priors	2	82		0.81	0.4473
Info. *x* Priors	2	205		2.02	0.1403
Error	65	3,290	50.6		
Corrected Total	70	8,799			

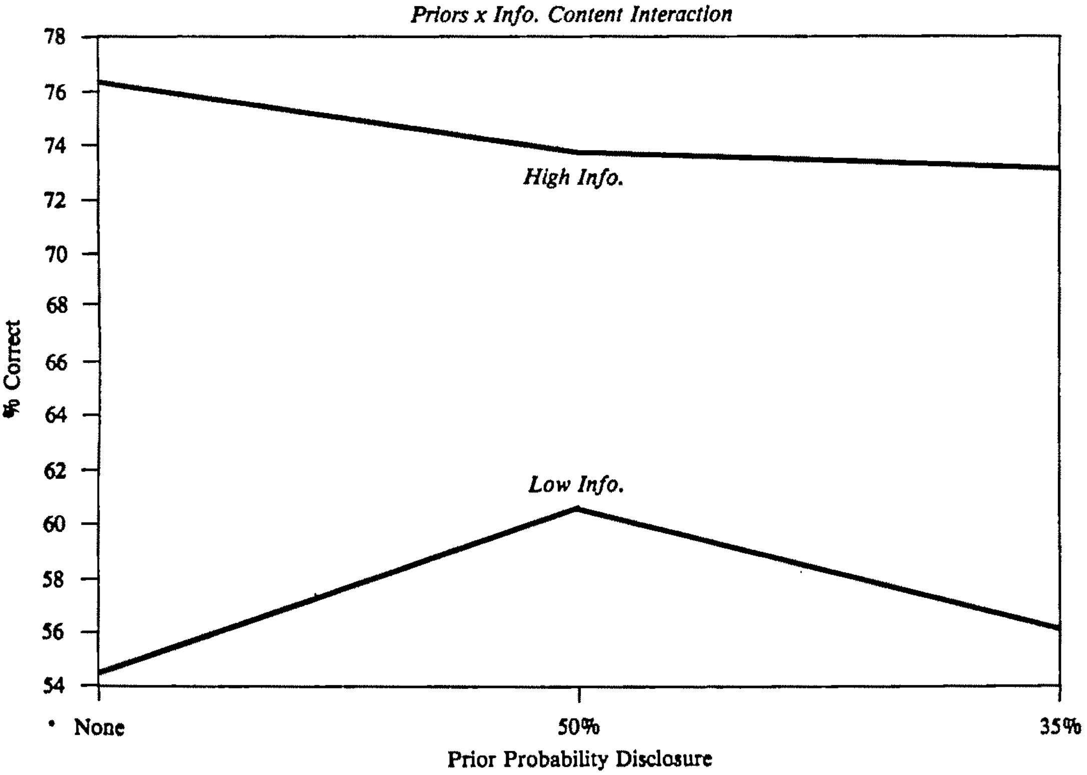
TABLE 3
ANOVA FOR TYPE I ERROR RATES

Source of Variation	*DF*	*Sum of Squares*	*Mean Square*	*F-Value*	*PR>F*
Treatments	5	4,288	857.6	11.02	0.0001
Info. Content	1	3,555		45.69	0.0001
Priors	2	196		1.26	0.2899
Info. *x* Priors	2	537		3.45	0.0377
Error	65	5,058	77.8		
Corrected Total	70	9,346			

TABLE 4
ANOVA FOR TYPE II ERROR RATES

Source of Variation	*DF*	*Sum of Squares*	*Mean Square*	*F-Value*	*PR>F*
Treatments	5	10,671	2,134.2	8.80	0.0001
Info. Content	1	7,208		29.73	0.0001
Priors	2	875		1.8	0.1727
Info. *x* Priors	2	2,588		5.34	0.0071
Error	65	15,757	242.4		
Corrected Total	70	26,428			

FIGURE 1
DEPENDENT VARIABLES: NUMBER OF CORRECT PREDICTIONS



also indicate no significant main effect of disclosure of the prior probability of bankruptcy for any of the accuracy indices and no significant overall interaction effect of task predictability and prior probability disclosure for the overall accuracy index.[8] The MANOVA indicates a significant interaction at an alpha level of .02, and there is no significant prior probability disclosure main effect.

The insignificant overall interaction (Table 2) results from the cancellation of significant individual interactions for each of the bankrupt and nonbankrupt groups. This finding is clearly displayed in the graphs of interactions in Figures 1, 2, and 3. When the true prior probability of 50 percent is disclosed to subjects with low task predictability, their Type II error rate (i.e., the prediction of nonbankrupt for a bankrupt firm) declines significantly, and their Type I error rate (i.e., the prediction of bankruptcy for a nonbankrupt firm) increases. For subjects with high task predictability, the opposite effect occurs. Their predictive accuracy declines for bankrupt firms and improves for the nonbankrupt firms when they are informed of the prior probability. The magnitude of the disclosure effect is greater

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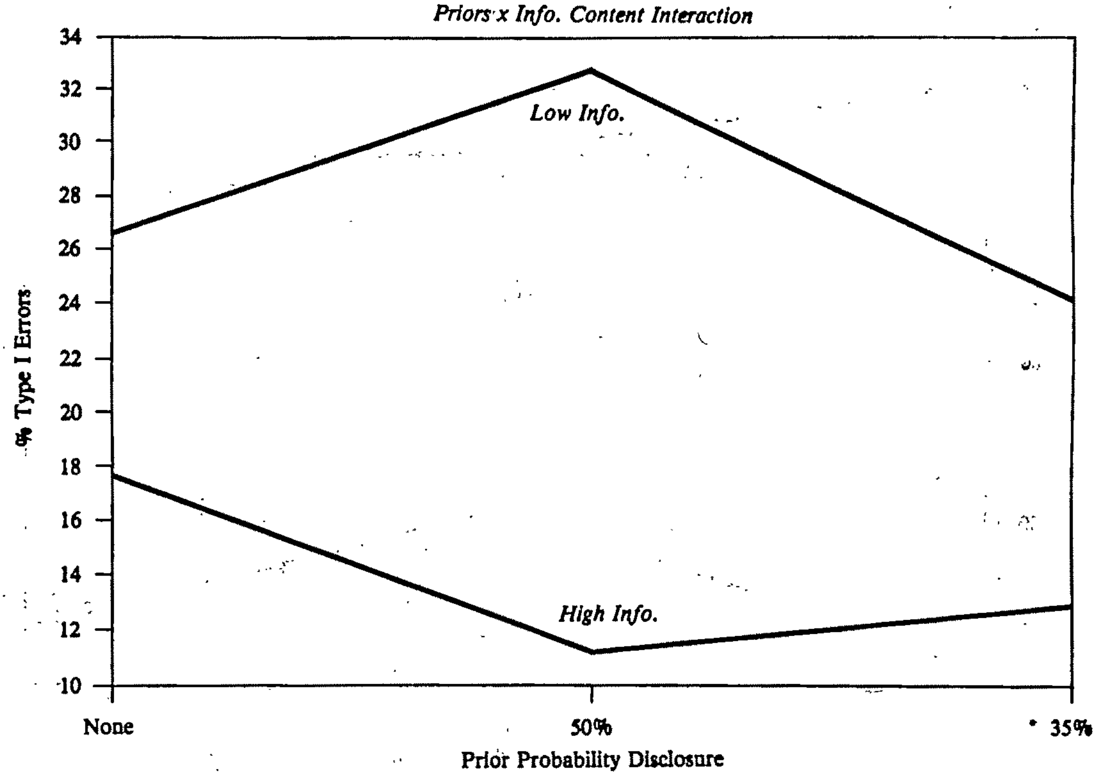
[8] Since cell entries are proportions and cell sizes are not identical, Bartlett's test for the inequality of several variances [Neter and Wasserman, 1974, pp. 509–512] was performed for each dependent variable on which ANOVAs were performed in this study. In all cases, the hypothesis of equal cell variances could not be rejected at any reasonable level of significance.

FIGURE 2
DEPENDENT VARIABLES: PERCENT TYPE I ERRORS



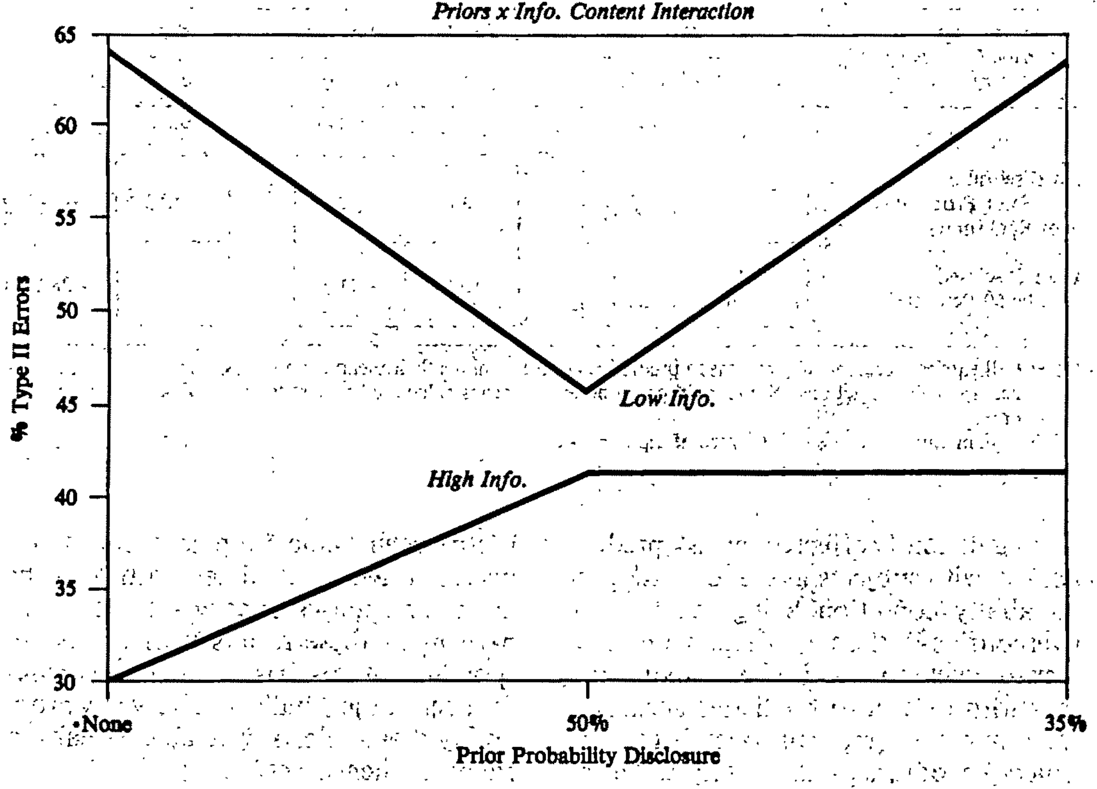
for the bankrupt firms than for the nonbankrupt firms, however, particularly for subjects in the low task predictability condition. This result is consistent with an untested hypothesis that subjects' own prior probabilities of bankruptcy were significantly lower than the sample frequency of bankruptcy in this study.

The disclosure of the 35 percent prior probability had less effect than the 50 percent disclosure on subjects' predictive accuracy relative to the no disclosure condition. There are two causes for this result. First, the predictive accuracy of subjects with low task predictability was affected only marginally, gauged by any of the three accuracy indices. Second, predictive accuracy for subjects with high task predictability was affected in different directions for bankrupt and nonbankrupt firms, impaired for the former and improved for the latter. The net result is a relatively small decline in these subjects' overall predictive accuracy.

Confidence

The MANOVA procedure applied to the mean subject confidence measures did not indicate any significant main effects or an interaction effect. The more interesting issue, however, is whether subjects were "justified" in their levels of confidence. The appropriateness of subjects' confidence level was defined as in studies of confidence in cognitive psychology (e.g., Fischhoff and Slovic [1980]): the difference between subjects' mean accuracy and subjects' mean assessment of

FIGURE 3
DEPENDENT VARIABLES: PERCENT TYPE II ERRORS



the certainty of the correctness of response. Thus, negative (positive) values for this difference indicate over-(under-) confidence. If subjects are perfectly calibrated, their mean probability judgment should equal their percentage correct [Lichtenstein and Fischhoff, 1977; Lichtenstein, Fischhoff and Phillips, 1977].

Subjects in the 35 percent prior probability treatment group were omitted from the following analysis of subject calibration, except for the graphs of the interactions. Interpretation of the results from this group would be difficult if not impossible, since there are an equal number of bankrupt and nonbankrupt firms in the test instrument. If the omitted subjects did not perceive any use for the data provided except for the prior probability disclosure, their optimal rule would have been to classify all firms as nonbankrupt. Consequently, their average confidence level would have been 0.65 and their accuracy only 0.50. It would be inappropriate to conclude that these subjects were overconfident.

The negative values in Table 5 indicate that subjects in this study were generally overconfident.[9] The overall result is associated primarily with overconfidence for the bankrupt companies. Overconfidence

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[9] A limitation of the metric chosen to measure calibration is that it assumes that subjects who express a confidence level of 0.50 are classifying firms randomly. The possibility exists that a subject has found a perverse rule that misclassifies more than half of the cases, and in addition, the subject may be very unsure about this rule and may respond by indicating the lowest measure of confi-

Table 5

Cell Means for Overconfidence

Disclosure of Prior Probability of Bankruptcy	*Overall*		*Non-Bankrupt Firms*		*Bankrupt Firms*	
	Task Predictability		*Task Predictability*		*Task Predictability*	
	High	*Low*	*High*	*Low*	*High*	*Low*
No Disclosure of Prior Probability of Bankruptcy	−3.6* (1.2)*	−23.8 (−39.1)	3.0	−2.8	−10.2	−44.8
Prior Disclosed to be 50 Percent	−8.0 (−11.6)	−20.1 (−20.7)	10.0	−11.3	−26.1	−28.9

Note: Cell entries represent subjects' mean predictive accuracy minus their mean certainty assessment of the correctness of their predictions. Numbers in parentheses are means calculated on last ten responses for each subject only.

* Not significantly different from zero at alpha = .10.

was significantly affected by task predictability, with subjects in the low task predictability condition being much more overconfident than subjects with high task predictability. Similar to our findings with respect to predictive accuracy, we found no significant overall interaction effect of task predictability and prior probability disclosure. There were, however, significant interactions when bankrupt and nonbankrupt firms were analyzed separately by groups, as Figures 4 and 5 indicate.

These findings for overconfidence result directly from our findings for predictive accuracy and confidence level. The significantly greater predictive accuracy and marginally greater confidence level of subjects in the high task predictability condition result in these subjects being significantly less overconfident *vis à vis* subjects in the low task predictability treatment.

Finally, a possible limitation of the analysis is that subjects may learn to calibrate themselves over time, and this is not captured in a metric based on all of the subjects' responses. The numbers in parentheses in Table 5 represent means for overconfidence calculated with only the last ten responses of each subject. Comparison of these means with the corresponding means based on 30 responses for each subject indicate a very low probability that subjects were able to learn to calibrate themselves.

Discussion

Our findings on the impact of variation in task predictability on judgment quality are consistent with the findings of Ashton [1981] and Houghton [1984], and the general finding of research in cognitive psychology [Brehmer, 1978]. Subjects who had "better" data, i.e., greater task predictability, performed significantly better in the experimental task.

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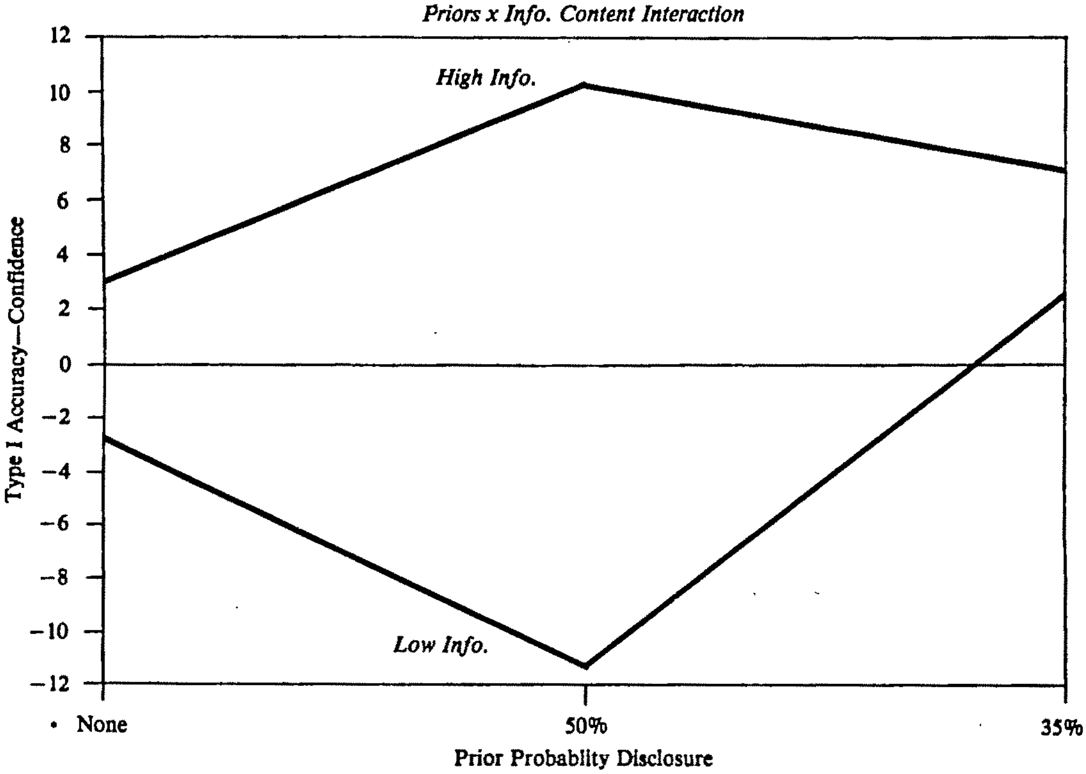
dence allowed. This hypothetical subject would erroneously be classified as overconfident since the percent predicted correctly would be lower than the average confidence level of 0.50. The possibility of this limitation having a material effect on the results was ruled out by counting the number of times each subject responded with a confidence level of 0.50. Of the 1,380 responses by subjects used in the analysis of calibration, only 18 responses of 0.50 confidence occurred.

FIGURE 4

DEPENDENT VARIABLES: TYPE I ACCURACY—CONFIDENCE

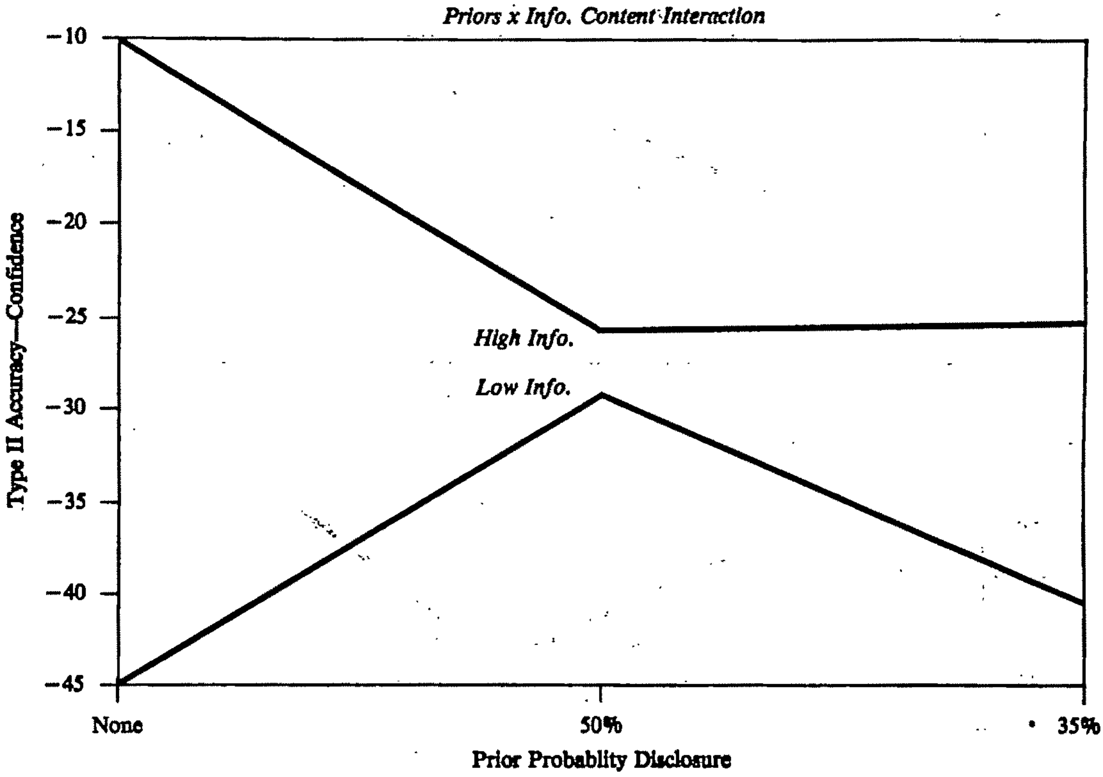


An important implication of the positive relationship between task predictability and subjects' performance may be that the users of accounting information systems should not be faulted for the inaccuracy of their predictions when task predictability is low. Bank loan officers and loan committees, for instance, are sometimes faulted *ex post* for extending credit to companies that ultimately experience financial distress. However, if the task predictability of the data used in making the credit judgment were low, it might be virtually impossible to correctly forecast the firm's future financial status. Creditors and other user groups might take our findings as a suggestion to analyze closely the task predictability of their own information systems.

Our results for task predictability lead us to reject the conclusion of others that differences in predictive accuracy among subjects in previous bankruptcy prediction studies can be attributed solely to differences in the treatment of disclosure of the prior probability of bankruptcy. The results presented here suggest that differences in task predictability are a more likely cause of the largest portion of those differences.

The findings for the efffect of variation in disclosure of the prior probability of bankruptcy are consistent with the previously cited findings of research in cog-

FIGURE 5
DEPENDENT VARIABLES: TYPE II ACCURACY—CONFIDENCE



nitive psychology that the effect depends on the informativeness of the sample data. While we did not measure subjects' perceptions, our results are consistent with Johnson's [1983] finding that the impact of prior probability disclosure is contingent upon subjects' perceptions of the representativeness of the sample data.

Our findings are not consistent, however, with Houghton's [1984] finding of a main effect for disclosure of the known frequency of bankruptcy. Also, although he did not test for an interaction effect with the age of accounting data, it is apparent from his reported results that there was none for the overall accuracy measure in his study. We cannot be sure of the reason(s) for the inconsistent findings, but observe that there were major differences in experimental design between Houghton's study and our own. Houghton's use of a repeated measures design may have created a "demand effect" by making the known frequency of bankruptcy variable more salient to the subjects. Also, Houghton's manipulation of the known sample frequency in contrast to the prior probability of bankruptcy was more likely to result in his subjects employing a gaming strategy involving counting their number of bankruptcy predictions.

Although Houghton tested for an effect of variation in the age of the accounting data and not task predictability, it is likely that he did vary task predictability effectively. Since he does not report the levels of task predictability, it is difficult to determine what impact the difference in the level of task predictability between the two studies might have made. We note, however, that the difference in subjects' predictive accuracy induced in Houghton's study was approximately nine percent as compared to approximately 17 percent in our study, suggesting that the data in Houghton's lower task predictability condition had greater predictive ability. Quite possibly, the contingent nature of an effect of prior probability disclosure itself depends on some threshold level of the informativeness of the sample data. If so, our study would appear to have reached the threshold level for activating the contingency effect. Finally, and perhaps the most likely explanation for the conflicting findings, there may have been undetected interaction effects in the Houghton study at the disaggregated levels of bankrupt and nonbankrupt firms.

Designers of accounting information systems might note the significant improvement in the performance of subjects with low task predictability when they are provided with information on the prior probability of bankruptcy. The importance of their overall improvement is magnified by the fact that it is due to their significantly decreased Type II error rate, generally agreed to be the more costly prediction mistake. This finding also highlights the value in disaggregating overall performance into Type I and II error rates. Had we not done so, we would have concluded that there was no significant interaction effect.

Our findings for the impact of variation in the independent variables on confidence level are of interest because confidence can be as influential a guide to future action for the individual as can his/her awareness of objective evidence of performance. The findings were consistent with a prevalent finding of research in cognitive psychology: subjects were generally overconfident. The level of overconfidence was significantly affected by task predictability, with subjects in the low task predictability condition being much more overconfident than subjects in the high task predictability condition. This result was particularly acute for the bankrupt firms. Subjects with "bad data" are simply unaware, it seems, of how poor their predictions of bankruptcy are. The following quote taken from Fischhoff and Slovic [1980, p. 16] seems particularly germane to our findings:

> People's overconfidence in their general knowledge and intellectual ability is apparently a widespread and robust tendency. . . . When confronted with a series of similar tasks, many people also generate an inappropriate global feeling of confidence . . . this feeling may come from . . . a culturally shared belief that the task (any task?) is tractable given the proper information . . . nothing short of telling subjects the task is impossible may be adequate.

Notwithstanding our findings and the above discussion on overconfidence, we note that predictions and outcomes are not always independent. For example, a loan officer's prediction that a firm will fail may be self-fulfilling if the loan officer's prediction is a major factor in denying credit to the company. Consequently, our general finding of overconfidence may be biased upward.

With respect to the association between confidence level and disclosure of the prior probability of bankruptcy, we conclude that "leaving well enough alone" may be a desirable strategy. That is, subjects with high (low) task predictability perform worse (better), i.e., are more (less) overconfident and have lower (higher) predictive accuracy when they are told the prior probability of bankruptcy. Furthermore, biased information on the prior probability does not significantly improve the prediction accuracy or lessen the overconfidence of those subjects with either high or low task predictability.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The generalizability of our findings could be limited by certain features of the experimental design. Subjects were not randomly selected and were not professional users of financial accounting information at the time of the study, although many had experience as bank lending officers and financial analysts and would enter those professions upon graduation. Whether the same results would occur for user groups such as commercial lenders is an untested empirical issue worthy of future research. The non-randomness of subject selection is probably of less cause for concern given that the participants were randomly assigned to treatment groups and that we found no significant between-group differences in the subjects' task-related background variables.

The exact levels of task predictability were unlikely to be equal to the levels we reported for accuracy of the statistical classification models. Classification accuracy of the statistical models was based on the inclusion of all available financial ratios, whereas the subjects used only a limited subset selected from the menu containing the larger set of ratios. Nevertheless, given the significant difference between the statistical classification accuracy of the two groups, it is most likely that the average subject in each of the two task predictability conditions used data that differed significantly in diagnosticity. Our findings for variation in task predictability are consistent with this assertion. Future research that measures more precisely the differences in task predictability and their associated effects on task performance would be useful.

Our manipulation of task predictability has the limitation of simultaneously altering other properties of the information set (e.g., cue intercorrelations). As explained earlier, this feature was purposely included to create a more representative experimental design. Future research could explore the possible impact of controlling for changes in the other features of the information set. Hammond [1982] provides a theoretical framework that identifies these features and proposes related testable hypotheses. The effects of variation in the other properties of information sets also might be studied using different tasks and task environment.

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Product Pricing Based on Accounting Costs

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ABSTRACT: Since various accounting costs are used in product pricing decisions, this paper identifies conditions under which a particular product cost is appropriate for use in product pricing. The approach used is to compare the output price selected using three accounting costs commonly used in pricing with the output price selected by a utility-maximizing decision maker conducting a complete analysis. This comparison indicates conditions under which each accounting cost leads to prices closest to those obtained after a complete analysis and is used to develop testable hypotheses about costing method use.

SURVEYS indicate that accounting costs are used in product pricing decisions [Gordon, et al., 1981; Govindarajan and Anthony, 1983]. This paper uses the theory of the firm under uncertainty [Leland, 1972] to identify conditions under which three commonly used costing methods—variable costing, full absorption costing, and normal-overhead absorption costing—are likely to be used. It also develops testable hypotheses about conditions under which each costing method would be used.

The paper presents the first-order conditions for a utility-maximizing decision maker setting price using a complete analysis, that is, omitting nothing of conceivable *ex ante* merit [Demski and Feltham, 1976, p. 19]. Complete analysis is costly, so its results are used as a benchmark against which to measure the result of a simplified analysis. The complete-analysis first-order conditions are compared to those arising when the decision maker uses accounting approximations to marginal cost to determine which of several commonly used product costing methods leads to selection of a price closest to that selected by a complete analysis.

The work of Dickhaut and Lere [1983] is extended in several directions in this paper. The decision maker is a price setter whose product has a downward-sloping demand curve. The analysis considers full absorption costing in addition to the two costing methods in Dickhaut and Lere. Uncertain demand is considered in addition to cost uncertainty. Finally, the choice of a level of activity over which to allocate fixed costs is addressed.

The first section of this paper is a formal description of the assumed setting. The next discusses deterministic demand and cost. The last two sections pair stochastic cost with deterministic demand and determinisitic cost with stochastic demand. These last two sections consider

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both risk-neutral and risk-averse decision makers.

THE SETTING

Assumptions about three elements describe the setting of this study: 1) the decision maker's ecomonic environment, 2) accounting reporting methods applied to the data available, and 3) the choice mechanism used to select an output price.

Economic Environment

1) The decision maker is a price setter facing a strictly downward-sloping demand curve. He or she knows the demand curve if demand is deterministic and knows the expected demand curve and probability density function if demand is stochastic, but must rely on an accountant to provide information on product cost.
2) The firm uses two inputs, v_1 and v_2. Input one is fixed at some level $\bar{v}_1$. The firm's purchases will not affect the prices w_1 and w_2 of these inputs.
3) The firm's cost function is $C(x) = g(x)w_2 + \bar{v}_1 w_1$, where $v_2 = g(x)$ expresses the relationship between the quantity of input two used and the quantity produced, x. $dg/dx > 0$ and $d^2g/dx^2 \geq 0$. That is, the cost function is either linear or increasing at an increasing rate.
4) Quantity produced equals quantity demanded. $x = x(P)$ is the function which relates quantity demanded, and therefore produced, to the possible output prices. If demand is deterministic, the output price selected uniquely determines quantity demanded and, therefore, quantity produced. If demand is stochastic, the output price selected determines an expected quantity demanded. Output is produced after actual demand is revealed. Instant print shops, automobile repair shops, electric utilities, and many restaurants set price and then produce a quantity equal to the quantity demanded at that price.
5) Second-order conditions are satisfied such that a unique global maximum of the function maximized exists.

Reporting Methods

The estimation process is costly such that determination of the marginal cost curve cannot be justified. Instead, the decision maker uses accounting product costs as approximations to marginal cost.

Three product costing methods are compared in this analysis: variable costing (VC), full absorption costing (FC), and normal-overhead absorption costing (NOC). Empirical studies indicate that these product costs are the ones commonly used [Gordon, et al., 1981, and Govindarajan and Anthony, 1983].

If cost is deterministic, the accountant using VC provides $g(x)w_2/x$. Using FC, the accountant provides $(g(x)w_2 + w_1\bar{v}_1)/x$. NOC results in reporting $(g(x)w_2/x) + (w_1\bar{v}_1/\bar{x})$, where $\bar{x}$ is some level of activity that does not change as the level of output chosen in a particular year changes.[1]

Choice Mechanism

The decision maker uses his or her knowledge of product demand and the accountant's product costs to select the price that equates marginal revenue and product cost.[2] The price selected satisfies the first-order condition

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[1] The relative cost of accounting systems is not addressed in this paper. In general, one would expect VC and NOC to be more costly than FC, since both VC and NOC require that costs be divided into fixed and variable components. Therefore, explicit consideration of this issue should not affect any relative rankings between VC and NOC but could improve the ranking of FC as an approximation for marginal cost.

[2] The specific choice mechanism is beyond the scope of this paper. It might be a learning process which takes place before the price is set [Dickhaut and Lere, 1983, pp. 499-501], a period of trial and error during which inven-

$$Px'(P)+x(P)-(g(x)w_2/x)x'(P)=0 \quad (1)$$

if the accountant reports VC product costs. If the accountant reports FC product costs, the price chosen will satisfy the first-order condition

$$Px'(P)+x(P)-((g(x)w_2+w_1\bar{v}_1)/x)x'(P)=0. \quad (2)$$

If the accountant reports NOC product cost, the price chosen will satisfy the first-order condition

$$Px'(P)+x(P)-((g(x)w_2/x)+(w_1\bar{v}_1)/\bar{x})x'(P)=0. \quad (3)$$

DEMAND AND COST ARE DETERMINISTIC

If the demand and cost curves are deterministic, the complete-analysis utility-maximizing price for the product satisfies the first-order condition

$$Px'(P)+x(P)-(g'(x)w_2)x'(P)=0. \quad (4)$$

Since first-order conditions (1), (2), and (3) differ from (4) only in that an accounting product cost is substituted for $g'(x)w_2$, the closer the approximation used is to marginal cost, the closer the price chosen using the accounting cost will be to the complete-analysis price.

To specify the relationships among the costs, it is necessary to indicate what level of output is used as the denominator activity $\bar{x}$ in NOC. It is initially convenient to assume that $\bar{x}$ equals the level of output at which the FC product cost is minimized, x_1. Later discussion indicates how this assumption affects the conclusions.

If the cost curve is linear, marginal cost and the VC product cost are the same at all levels of output. Both FC and NOC product costs are greater than marginal cost at all levels of output.

If cost increases at an increasing rate, then relative size of the costs differs for outputs above and below x_1. For levels of output above x_1, marginal cost will be the largest of the costs; the NOC product cost will be next largest; the FC product cost will be the third largest; and the VC product cost will be the smallest. For levels of output below x_1, the FC product cost will be largest; the NOC product cost will be next largest; marginal cost will be third largest; and the VC product will be smallest.

Therefore, conclusions depend on the shape of the cost curve and the relationship of output to x_1, the FC-minimizing output. 1) If the cost curve is linear, then only variable costing leads to the complete-analysis price. 2) If cost increases at an increasing rate and output is greater than x_1, then NOC product costing leads to a price closer to the complete-analysis price than do FC or VC product costing. Between FC and VC, FC product costing leads to a price closer to the complete-analysis price. 3) If cost increases at an increasing rate and output is less than x_1, NOC product costing leads to a price closer to the complete-analysis price than does FC product costing. Neither NOC nor VC product costing consistently leads to a price closer to the complete-analysis price. Above some level of output, x_2, NOC product costs lead to prices closer to the complete-analysis price; below x_2, VC leads to prices closer to the complete-analysis price.

If $\bar{x}$ does not equal x_1, there is a range of output around x_1 for which FC leads to a price closer to the complete-analysis price than does NOC. This range increases as the difference between $\bar{x}$ and x_1 increases. An $\bar{x}$ less than x_1 also increases x_2; an $\bar{x}$ greater than x_1 decreases x_2. Testable im-

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tory growth or stock-outs occur, or a cost-plus pricing rule [Baumol and Quandt, 1964, p. 28].

Assuming that the decision maker uses an optimizing technique with a simplified information set is not unique to this analysis. See, for example, Baumol and Quandt [1964] and Zimmerman [1979, pp. 512–513].

plications of this section all apply to firms whose decision makers face little or no uncertainty. VC use is predicted for firms with linear cost curves.

Firms with cost curves increasing at an increasing rate can be used to test several hypotheses. They are predicted to use NOC or FC. A more detailed hypothesis is that firms operating well below capacity are predicted to use VC; firms operating near their cost-minimizing level of output are predicted to use FC; other firms are predicted to use NOC. One might also test the hypothesis that firms using NOC are more likely to use the cost-minimizing level of output as a denominator activity than other levels of activity. These hypotheses could be tested with observations on actual costing method use.

Deterministic Demand and Stochastic Cost

Stochastic cost curves occur because the product cost used to select price is a forecast and because cost determination is subject to measurement errors.

A stochastic cost function is defined as $C(x,u)$, where u is a random variable with a subjective probability density function. The results in this section assume two conditions are met by this function: 1) $\delta C(x,u)/\delta x>0$ and 2) both $\delta C(x,u)/\delta u$ and $\delta(\delta C(x,u)/\delta x)/\delta u$ are strictly positive or strictly negative. The first condition is equivalent to requiring that a deterministic cost be increasing. The second condition indicates that a change in the random variable changes both cost and marginal cost in the same direction.

Uncertain technology such that the function $g(x)$ is replaced by $g(x,u)$ is consistent with the definition of cost uncertainty as long as 1) $\delta g(x,u)/\delta x>0$ and 2) both $\delta g(x,u)/\delta u$ and $\delta(\delta g(x,u)/\delta x)/\delta u$ are strictly positive or strictly negative.

Input price uncertainty can also be consistent with the definition of cost uncertainty. If both prices are uncertain such that w_1 and w_2 are replaced by $w_1(u)$ and $w_2(u)$, then w_2 must be strictly increasing or strictly decreasing in u and some relationship must exist between dw_1/du and dw_2/du since $\delta C(x,u)/\delta u=g(x)dw_2/du+y_1dw_1/du$. The sign of $\delta C(x,u)/\delta u$ must be the same as the sign of dw_2/du. dw_1/du having the same sign as dw_2/du, which would occur if the uncertainty is related to a general rise in input prices, satisfies this condition.

To evaluate product costing methods, it is assumed that the accountant uses $E[g(u|x)]$ in computing product costs if the technology is uncertain and $E[w_1(u)]$ and $E[w_2(u)]$ in computing the product cost if the input prices are uncertain.

With cost uncertainty, the complete-analysis price that maximizes expected utility differs between risk-neutral and risk-averse decision makers. A proof similar to that of Dickhaut and Lere [1983, pp. 510–512] shows that the complete-analysis price that maximizes expected utility for a risk-neutral decision maker is the same price that would maximize utility if cost is deterministic. Therefore, results for a risk-neutral decision maker are the same as those if cost is deterministic.

A risk-averse decision maker will maximize expected utility at a higher price than the price at which utility would be maximized if the cost curve is deterministic. This occurs because the complete-analysis costs now include the operating costs traditionally captured in the accounting system as well as a risk premium arising because operating costs are uncertain.

A VC product cost will not lead the risk-averse decision maker with a linear cost curve to select the same price as will a complete analysis. Whether VC, FC, or NOC leads to a price closer to the complete-analysis price depends on the size of the risk premium, the size of the fixed cost, and the denominator activity used in NOC.

TABLE 1

SUMMARY BASED ON LELAND'S RESULTS

	Shape of Cost Curve	
	Linear	*Increasing Marginal Cost*
Risk-Neutral	$P^*=P_c$	$P^*>P_c$
Risk-Averse and $\delta\pi(P_m,u)/\delta P$ monotonically decreasing in u	$P^*>P_c$	$P^*>P_c$
Risk-Averse and $\delta\pi(P_m,u)/\delta P$ independent of u	$P^*=P_c$	$P^*>P_c$
Risk-Averse and $\delta\pi(P_m,u)/\delta P$ monotonically increasing in u	$P^*<P_c$	$P^* \gtrless P_c$

P^* is the expected utility-maximizing price.
P_c is the price that would be selected if the demand curve were deterministic.

The fixed cost per unit included in FC and NOC serves as an approximation of the risk premium.

The risk-averse decision maker with a cost curve increasing at an increasing rate is likely to prefer NOC or FC to VC. Here, the risk premium is added to an increasing marginal cost and expands the range over which NOC and FC lead to a price closer to the complete-analysis price than will VC. In addition, NOC product costs will now be preferred to VC product costs at even lower levels of $\bar{x}$ than when cost is deterministic.

Testable hypotheses might compare the costing methods used between the deterministic cost/deterministic demand and the stochastic cost/deterministic demand cases. These hypotheses might best be tested in a laboratory setting in which cost certainty and uncertainty can be controlled. If cost is uncertain, risk-neutral decision makers are predicted to use the same costing methods as if cost and demand are deterministic. Risk-averse decision makers are more likely to use FC or NOC if cost is stochastic than if cost is deterministic.

STOCHASTIC DEMAND AND DETERMINISTIC COST

Stochastic demand is defined as $f(P,x,u)=0$, where u is a random variable. For any u, the demand relationship is restricted by assumption so that the relationship between P and x is downward-sloping and larger values of u are associated with greater quantity demanded. In addition, the dispersion of total revenue is assumed to increase as total expected revenue increases due to changes in P. Partials are assumed to exist to permit $x=x(P,u)$ $[\delta x(P,u)/\delta P<0;\ \delta x(P,u)/\delta u>0]$ [Leland, 1972].

Table 1 is based upon Leland's comparison of the prices a decision maker with deterministic demand would select and those prices a decision maker with stochastic demand would select [1972, pp. 284–6]. Leland assumes that $\delta\pi(P,u)/$

δP is differentiable and imposes certain requirements on $\delta\pi(P_n,u)/\delta P$, where π is the profit function and P_n is the optimal price for the risk-neutral decision maker, that are further restrictions on the condition that the dispersion of total revenue is assumed to increase as total expected revenue increases due to changes in P. The entries in the table compare the price that maximizes expected utility and the price that would maximize utility if demand were deterministic. As one can see from Table 1, risk attitude and the shape of the cost function affect the conclusions.

If the cost curve is linear, the risk-neutral decision maker with stochastic demand will select the same price to maximize expected utility as will the decision maker with a deterministic demand curve. As shown earlier, a VC product cost leads to the complete-analysis price.

The risk-neutral producer with stochastic demand and a marginal cost curve increasing at a non-decreasing rate will select a higher price to maximize expected utility than if the demand curve is deterministic. The marginal cost curve such that the risk-neutral decision maker facing deterministic demand would select the same price as would the risk-neutral decision maker facing the stochastic demand curve is above and to the left of the marginal cost curve. The difference between the certainty equivalent marginal cost curve and the marginal cost curve typically is not captured in accounting systems. This difference expands the range of output for which the absorption costing product costs are preferred to VC product costs. It also results in NOC being preferred to VC for even lower levels of x than when demand is deterministic.

If the decision maker is risk-averse, then in most cases the range for which absorption costing product costs are preferred to VC product costs is expanded. If, however, the firm has a linear cost function and $\delta\pi(P_n,u)/\delta P$ is independent of u, the complete-analysis price is the same as under certainty. Therefore, VC will yield the complete-analysis price.

The risk-averse decision maker with $\delta\pi(P_n,u)/\delta P$ increasing in u either would require a product cost with properties other than those considered in this paper, or else would require a product cost whose properties cannot definitely be determined. Therefore, this case is not discussed further.

The nature of the demand uncertainty is important to testable hypotheses when demand is stochastic. Therefore, these hypotheses might best be tested in a laboratory setting in which the nature of the demand uncertainty can be controlled.

For risk-neutral decision makers, one might test the hypothesis that those with linear cost curves are no more likely to use NOC or FC than if demand is deterministic. If cost increases at an increasing rate, NOC or FC use is more likely than if demand is deterministic.

For risk-averse decision makers with linear cost curves, one might test the hypothesis that VC use is predicted if $\delta\pi(P_n,u)/\delta P$ is independent of u.

SUMMARY

This paper compares the ability of three common product costs—1) variable costing, 2) full absorption costing, and 3) normal-overhead absorption costing—to lead a price-setting decision maker to select a price close to the price selected if a complete analysis were conducted.

Conclusions depend on the conditions under which the decision maker selects a price. Variable costing leads to the complete-analysis price for firms with linear cost curves as long as 1) demand and cost curves are deterministic, 2) the decision maker is risk-neutral, or 3) the stochastic nature of the demand curve meets certain conditions. In all other cases, variable costing leads to a price closer to the complete-analysis price than absorption costing only at relatively low levels of output. Absorption costing leads to a price closer to the complete-analysis price for all levels of output above some relatively low level 1) if the cost curve increases at an increasing rate or 2) if the cost curve is linear and the risk-averse decision maker faces stochastic cost or stochastic demand that meets certain conditions. Between the two forms of absorption costing, the method that leads to the price closer to the complete-analysis price depends on the level of output over which the fixed cost is allocated in normal-overhead absorption costing.

Since existing empirical studies of product pricing do not consider the characteristics in the testable hypotheses developed in this paper, further empirical study is necessary to determine how well these hypotheses predict costing method use.

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A Note on Yield Variance and Mix Variance

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ABSTRACT: The sales activity variance as well as the corresponding production variance are typically partitioned into a yield variance and a mix variance. These latter variances have a defect which can lead to dysfunctional decisions. Since these variances are based on an average unit price which varies with respect to the unit of measurement selected, the same real events can appear as positive or negative variances. Alternative variances for mix and yield which do not have the above defect are suggested, based on expressing the units of goods sold by their cost of production.

THE sales activity variance is typically partitioned into a yield variance and mix variance. This division is commonly advocated in academic articles as well as textbooks. The yield variance measures the effect of changes in physical volume on the contribution margin, and the mix variance measures the impact due to changes in the relative composition of the different goods sold. Further explanations appear in Kaplan [1982], Horngren [1982], Hasseldine [1967], Shank and Churchill [1977], and Wolk and Hillman [1972], among others. These variances are calculated after subtracting the sales price variance. However, as pointed out by Manes [1983], in a nonperfectly competitive market structure, prices and quantities sold are interrelated. Thus, the relavant variances and the analysis based on these variances are interrelated as well. A similar decomposition applies to the analysis of the input quantity variance whenever there are several factors of production. This paper shows that this analysis has a serious inherent defect which can bring about misleading results.

Following the traditional literature, the above variances for the sales are defined as follows:

$$\text{Sales activity variance} = \sum_i \Delta X_i P_i,$$

$$\text{yield variance} = \sum_i \Delta X_i \bar{P} = \bar{P} \sum \Delta X_i,$$

and,

$$\text{mix variance} = \sum_i \Delta X_i (P_i - \bar{P}),$$

where[1]

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[1] An alternative approach is to define production mix/yield variances as follows:

$$\text{Yield variance} = \sum_i (\bar{X}_i - X_i) P_i,$$

$$\text{mix variance} = \sum_i (X_i + \Delta X_i - \bar{X}_i) P_i,$$

where X_i, P_i, ΔX_i, and $\bar{P}$ are defined as above, and

$$\bar{X}_i = \left[\sum (X_i + \Delta X_i) \right] \frac{X_i}{\sum X_i}.$$

It can be shown that the variances defined in the sales approach and the production approach are equal.

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ΔX_i=change from the budgeted quantity of product i, $i=1 \ldots n$,

P_i=budgeted contribution margin per unit of product i, namely, selling price minus variable costs, and

$\bar{P}$=budgeted average contribution margin per unit or

$$\sum_i X_i P_i / \sum_i X_i$$

(where X_i budgeted quantity of product i).

Note that

$$\sum_i \Delta X_i P_i = \sum_i \Delta X_i \bar{P} + \sum_i \Delta X_i (P_i - \bar{P}).$$

The above decomposition is based on the term $\bar{P}$ which is defined as the average contribution per unit of product. However, the notion of a unit of product is arbitrarily defined. Consider a grocery store selling bread and milk. What is the common denominator for a unit of product?[2] One possibility is the economic dollar value of the products, and this is precisely expressed in the sales activity variance. But for the purpose of the yield and mix variances, what is the unit for which we calculate $\bar{P}$? We can use, for example, weight or volume. The relative share of bread and milk in the formation of $\bar{P}$ will differ if the unit is pound or gallon (or loaf or bottle), and it may differ more if one is heavily weight-intensive or the other volume-intensive. Or consider the example of an airline (or railroad) company that carries passengers and cargo. The passenger output can be measured by passenger/mile units, and the output of cargo can be measured by ton/mile units. Neither of the two types of output can be measured meaningfully in units of the other.

Moreover, instead of cargo units of ton/mile, it can be 1,000 pounds/mile such that (roughly) a ton/mile unit equals two units of 1,000 pounds/mile. The choice of the units is arbitrary, but it may determine both the size and the sign of the variance and hence, the performance evaluation of the firm. To demonstrate, consider the following example:

A firm sells two products, 1 and 2, at quantities X_1 and X_2. Using one definition of a unit, the firm's budget is as follows:

$X_1=100$ units, $P_1=1$, $(X_1P_1=100)$.
$X_2=100$ units, $P_2=1$, $(X_2P_2=100)$.
and hence $\bar{P}=1$.

The actual performance shows deviations from the budget of plus ten percent and minus ten percent at the amounts:

$\Delta X_1=-10$
$\Delta X_2=+10$

Hence the sales activity, yield and mix variances are all zero.

Suppose the firm chooses another unit of measurement for product 2, say $\hat{X}_2$, such that one unit of $\hat{X}_2$ equals two units of X_2. Assume actual performance is unchanged. The budget according to the present definition of a unit is:

$X_1=100$ units, $P_1=1$, $(X_1P_1=100)$.
$\hat{X}_2=50$ units, $\hat{P}_2=2$, $(\hat{X}_2\hat{P}_2=100)$.
and $\bar{P}=1\frac{1}{3}$.
$\Delta X_1=-10$.
$\Delta\hat{X}_2=5$.

Hence, the sales activity variance is zero as before, but the yield variance will be -6.67 (the change in the number of units is $\sum \Delta X_i=-5$) while the mix variance is 6.67.

Let the firm choose a third definition of a unit of product 2, say X_2^*, such that two units of product X_2^* will equal one unit of

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[2] A similar question arises concerning the term X_i when using the production approach definitions. What is the meaning of a number representing an arithmetic summation of the number of units of different goods?

X_2. Still, as before, the firm will have the same real performance. The budget will be:

$X_1=100,\ P_1=1,\ (X_1P_1=100).$
$X_2^*=200,\ P_2^*=\frac{1}{2},\ (X_2^*P_2^*=100).$
$\bar{P}=\frac{2}{3}$
$\Delta X_1=-10.$
$\Delta X_2^*=20.$

Hence, the sales activity variance is zero, as before, but the yield variance is 6.67 ($\sum \Delta X_i=10$) while the mix variance is -6.67.

A necessary requirement for a scale, or a variance, is that a certain phenomenon should be isomorphically mapped to the scale. Thus, for example, if A and B are two straight lines and $A>B$, it should be so whether the lines are measured by inches, feet, yards, meters, etc. In each of the above three cases the same real events took place; that is, quantity changes of each product and the relative change in the mix were the same. Hence, they should produce the same sign and magnitude of variances. But only the sales activity variance was the same in the three cases. The measured mix and yield variances showed both magnitude and directional differences, depending on the selection of a unit of measurement. A positive variance can be shown as a negative one just by altering the units of measurement. In other words, while the sales activity variance is a valid quantity variance, its decomposition into yield and mix variances is somewhat arbitrary and may mislead management. The more heterogeneous the products and the greater the change in their mix, the less reliable are the yield and mix variances.

In the case of sales, a solution to the above problem is to substitute a common denominator such as dollar cost of the actual units sold. Thus, units of goods sold will be expressed, or weighted, by their cost of production. Let us define the following additional terms:

C_i = budgeted variable cost of production of a unit of product i.

$R_i=\dfrac{P_i}{C_i}$ = budgeted contribution margin per dollar of cost.

$\bar{R}=\dfrac{\sum P_iX_i}{\sum X_iC_i}$ = budgeted average contribution margin per dollar of cost.

The mix variance is now defined as:

$$\sum \Delta X_iC_i(R_i-\bar{R})$$

The yield variance is now defined as:

$$\sum \Delta X_iC_i\bar{R}=\bar{R}\sum \Delta X_iC_i$$

Notice that the mix and yield variances still add up to the usual activity variance ($\sum \Delta X_iP_i$) as can be seen by summing the two variances and replacing R_i and $\bar{R}$ by their right-hand expressions in the foregoing definitions.

Both variances are now invariant with respect to the unit of measurement of a physical unit X_i. The relevant units are now actually units of cost of producing a product and the contribution is a contribution margin per dollar of cost of production. The yield and mix variances derive their meaning from contribution margins or the return to dollars of production cost. The mix variance now expresses the change in return due to changes in the mix of rates of return on cost while the yield variance results from the dollar quantity of cost.

To demonstrate the suggested solution, let us extend the above example. In the first case we have the following budget and deviations from the budget:

$X_1=100,\ X_2=100,\ \Delta X_2=-10,$ and $\Delta X_2=+10.$

Add the information on cost as follows:

$C_1=1$ and $C_2=2$.

And calculate

$$R_1=1,\ R_2=\frac{1}{2},\ \text{and}\ \bar{R}=\frac{100+100}{100+200}=\frac{2}{3}.$$

The yield variance is now 6.67, the mix variance is -6.67, and the sales activity variance is zero.

In the second case we have the following cost figures:

$C_1=1$ and $\hat{C}_2=4$.

And

$$R_1=1,\ \hat{R}_2=\frac{1}{2},\ \text{and}\ \bar{R}=\frac{2}{3}.$$

All the variances are as in the previous case. In the third case, the figures are as follows:

$$C_1=1,\ C_2^*=1,\ R_1=1,\ R_2^*=\frac{1}{2},$$
$$\text{and}\ \bar{R}=\frac{2}{3}.$$

Once again the variances are as in the previous cases.[3]

One variant to the above solution is to replace dollars of input by dollars of output, namely dollars of cost by dollars of sales. The only change in the above formulation is to change the definition of C as follows:

C_i=budgeted sale price of a unit of product i.

All relationships demonstrated above remain valid, but sales dollars serve as the scale of measurement. Notice that the method of dollar-sales can only be used when P is defined as the contribution margin. When P is a selling price the method cannot be used.

This method of sales-dollars was known and appeared in the past in accounting textbooks, i.e., Horngren [1972], who considered it as inferior to the currently advocated method of using physical units.[4] In more recent editions of the same textbooks (as well as others), the sales-dollar method disappeared.

SUMMARY

The partition of sales activity variance (and input variance) into a yield variance and a mix variance via the currently advocated physical unit method can bring dysfunctional decisions. It was shown that by changing the unit of measurement of one good (while not changing that of the other goods), the results of the above variances will be changed, and hence so will the conclusions. Therefore, physical units are not a good denominator for the above analysis.

This paper has demonstrated that a preferred alternative method is to use dollars of cost as the common denominator for calculating the variances.

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[3] Notice that R_1, R_2, and $\bar{R}$ are the same in the three cases. This is expected since the rates of return per dollar of cost should not be affected by the specific definition of a unit of product.

[4] Horngren's well-known textbook [1972, pp. 884–887], presents the "sales-dollar method" yet he claims that the "physical-quantity method seems more informative than [the dollar sales method]. It tells the decision maker all that is contained in the [dollar sales method], and perhaps more clearly" [p. 886]. Also, no defect is recognized to exist in the physical-quantity method, as "there is no single right or wrong method for variance analysis" [p. 882].

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Additional Considerations When Using the FASB Data Bank of Changing Price Information

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ABSTRACT: In a recent issue of *The Accounting Review*, Stone and Bublitz (S&B) [1984] report on the frequency of data collection errors for the 1981 FASB computer tape containing FAS 33 disclosures for 1979 and 1980. This paper extends their work by examining the problems encountered when using a subsequent version of that data base in conjunction with the Compustat and Value Line historical cost data bases. Failure of the data bank user to reconstruct the difference between historical cost and current cost amounts in the supplementary disclosures of a firm's annual report is designated as an error. Errors in income and depreciation expense for a filtered sample of 171 firms are reported for the years 1979 through 1982. An error rate for income in 1981 of 12.9 percent and error rates for depreciation ranging from 23.4 to 39.8 over the four years seem to suggest that manual checking of annual reports is necessary when using these amounts.

To encourage research on the effects of changing prices, the Financial Accounting Standards Board (FASB) has made available a computer data bank containing the supplementary disclosures of constant dollar and current cost amounts reported by firms under Statement of Financial Accounting Standards (FAS) No. 33 [FASB, 1979]. Stone and Bublitz [1984] compared the accuracy of data on the FAS 33 data bank with annual reports. This paper examines problems encountered in using two key variables from the FAS 33 data bank in conjuction with either the Compustat or the Value Line historical cost data banks.

COMPATIBILITY

The *FAS 33 Data Bank User's Manual* [Vasarhelyi, Phillips, and Alusik, 1984, p.1] states: "The Data Bank does not contain historical cost information. The Data Bank is, however, designed to be compatible with financial information in other data bases, such as the Value Line data base published by Arnold Bernhard & Co., Inc." The difference between the historical cost and current cost amounts (hereafter, differential) is the object of interest in many applications of the FAS 33 data bank.[1]

The provisions of FAS 33 do not require disclosure of historical cost amounts that are comparable to their constant dollar

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[1] The differentials for cost of sales and/or depreciation expense are commonly referred to as holding gains and losses.

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and current cost counterparts. However, disclosure of sufficient information to calculate comparable amounts is required [FASB, 1979, para. 32]. Most companies followed the examples in the appendices of that pronouncement and presented either side-by-side columns of historical cost, constant dollar, and current cost data or reconciliations from historical cost to the other amounts.

The decision to exclude the historical cost amounts from the FAS data bank, and instead rely on compatible supplementary sources, requires that the current cost data be recorded in the FAS 33 data base so that the differential is maintained with the supplementary sources.[2] The following paragraphs evaluate the success in achieving compatibility between historical cost data bases and current costs reported on the FAS 33 data bank for two variables of major interest to researchers: income from continuing operations (IFCOCC) and depreciation (DEPRCC). Constant dollar variables were not examined, in part, because of the FASB's [1984] decision to rescind the disclosure requirement for this type of data.

Sources of Data

To evaluate the compatibility of IFCOCC (DEPRCC) with its historical cost counterpart, IFCOHC (DEPRHC), the annual reports of 171 firms were examined for the years 1979, 1980, 1981, and 1982. The IFCO and DEPR differentials computed from data in the annual reports[3] were compared to those resulting from the use of the FAS 33 Data Bank in conjunction with Standard and Poor's Compustat Industrial tape and Value Line Data Base II of Arnold Bernhard & Co., Inc. The sample, while being nonrandom, was not arbitrarily chosen. Instead, it was derived by applying a set of filters[4] to all firms in the FAS 33 data bank.

IFCOCC was taken from the 1982 FAS 33 tape (i.e., version III) and restated from average 1982 dollars to average dollars of the appropriate year—1979, 1980, or 1981. When IFCOCC was missing on the tape, the unprocessed data field NB08 (NB41 for reconciliation format firms) was extracted and adjusted as necessary to average dollars of the appropriate year. DEPRCC was adjusted in a similar manner, with field NB06 used as necessary.

IFCOHC from Compustat consists of field 18 (income before extraordinary items and discontinued operations), while the combination of variables producing the lowest error rate was used from Value Line.[5] DEPRHC was pulled from two

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[2] For example, if current cost depreciation exceeds historical cost depreciation by $1.1 million in the company's supplementary disclosure, then the current cost depreciation recorded in the FAS 33 Data Bank must be $1.1 million more than the depreciation reported in the "compatible supplementary source" (such as Value Line). In some cases, this would require entering an amount in the FAS data bank that differs from the current cost amount reported in the footnote. This approach was employed by Value Line in reporting replacement cost data [Value Line, 1980, Ch. 8, p. 1].

[3] The original differentials were corrected for noncompliance "errors," such as including extraordinary gains and losses in IFCO. Also, the current cost amounts were restated, when necessary, into average dollars before computing the reported differentials. For noncomplying firms that did not report a comparable historical cost reconciliation amount in the supplementary disclosures, the differential computed from the data bases was assumed to be correct.

[4] These filters are similar to those used in an earlier study by the authors [Swanson, Shearon and Thomas, 1985] and would likely be appropriate for other research employing the longest available time-series of current cost and replacement cost data. Specifically, firms in industries with what the FASB generally referred to as "specialized assets" (mineral-ore bodies, timberlands and growing timber, income-producing real estate, oil and gas reserves, and motion pictures) were excluded because many of them report historical cost/constant dollar data as current cost. Utilities and firms experiencing a name change or merger also were excluded. Furthermore, firms were required to: (1) have a December or January year-end, (2) have reported current cost data for 1979–1982 and replacement cost data for 1976–1978, and (3) be contained on both the Value Line and Compustat data bases.

[5] The lowest error rate resulted from adding fields 28 (income before extraordinaries) and 168 (special items) and subtracting field 26 (special non-recurring gains and losses).

TABLE 1

ERRORS RESULTING FROM USE OF CURRENT COST IFCO FROM FAS 33 DATA BANK IN CONJUNCTION WITH HISTORICAL COST IFCO FROM COMPUSTAT OR VALUE LINE

		Frequency			*Materiality*			
					Median Understatement		*Median Overstatement*	
Year	*Applicability/cause of error*	*Number of Differential* Under-Statements*	*Number of Differential* Over-Statements*	*Total Number of Errors (%)***	*Dollars (Millions)*	*Percent****	*Dollars (Millions)*	*Percent****
1979	Errors arising with the use of either COMPUSTAT or Value Line:							
	Processed IFCOCC wrong because dollar-size index wrong.	1	3	4	4.9	1.6	4.1	17.3
	IFCOCC in data bank differs from AR for no apparent reason.	2	0	2	132.9	335.5	0	0
	HC in primary statements differs from HC in FAS 33 note.	1	0	1	1,418.7	72.4	0	0
	IFCOCC in data bank includes a cumulative effect.	0	1	1	0	0	13.5	287.2
	Subtotal	4	4	8				
	Additional errors arising with the use of COMPUSTAT	1	0	1	13.4	27.2	0	0
	Additional errors arising with the use of Value Line	0	5	5	0	0	14.4	16.6
	Total errors arising with the use of COMPUSTAT	5	4	9 (5.3)	13.4	27.2	4.6	20.1
	Total errors arising with the use of Value Line	4	9	13 (7.6)	133.4	46.4	5.4	17.3
1980	Errors arising with the use of either COMPUSTAT or Value Line:							
	Processed IFCOCC wrong because dollar-size index wrong.	1	0	1	9.6	2.8	0	0
	IFCOCC in data bank differs from AR for no apparent reason.	1	1	2	301.4	39.9	5.7	21.5
	HC in primary statements differs from HC in FAS 33 note.	1	0	1	14.6	22.8	0	0
	Subtotal	3	1	4				
	Additional errors arising with the use of COMPUSTAT	1	0	1	23.4	44.6	0	0
	Additional errors arising with the use of Value Line	1	3	4	.7	8.8	2.0	14.7
	Total errors arising with the use of COMPUSTAT	4	1	5 (2.9)	19.0	31.4	5.7	21.5
	Total errors arising with the use of Value Line	4	4	8 (4.7)	12.1	15.8	3.8	18.1

1981 Errors arising with the use of either COMPUSTAT or Value Line:							
Processed IFCOCC wrong because dollar-size index wrong.	2	3	5	.4	2.1	.6	4.9
IFCOCC in data bank differs from AR for no apparent reason.	2	1	3	77.7	850.0	5.0	25.0
HC in primary statements differs from HC in FAS 33 note:							
Due to the use of FAS 8 in note but FAS 52 on I.S.	1	9	10	31.6	51.0	7.2	38.6
Due to other reasons.	1	1	2	65.0	7.0	1.8	8.5
Constant dollar or some other amount recorded as IFCOCC.	0	1	1	0	0	16.6	30.1
IFCOCC in data bank has the wrong sign.	1	0	1	35.9	131.5	0	0
Subtotal	7	15	22				
Additional errors arising with the use of COMPUSTAT	0	0	0	0	0	0	0
Additional errors arising with the use of Value Line	4	3	7	9.8	41.5	13.0	40.0
Total errors arising with the use of COMPUSTAT	7	15	22(12.9)	31.6	44.1	4.8	25.0
Total errors arising with the use of Value Line	11	18	29(17.0)	16.3	44.1	4.9	26.0
1982 Errors arising with the use of either COMPUSTAT or Value Line:							
IFCOCC in data bank differs from AR for no apparent reason.	1	2	3	18.7	99.5	4.4	49.5
Constant dollar or some other amount recorded as IFCOCC.	2	2	4	197.8	77.2	55.9	687.7
Processed IFCOCC wrong because Y/E $ not converted to avg. $.	1	0	1	2.6	3.5	0	0
IFCOCC in data bank includes a cumulative effect.	1	0	1	6.2	2.6		
Subtotal	5	4	9				
Additional errors arising with the use of COMPUSTAT	0	0	0	0	0	0	0
Additional errors arising with the use of Value Line	9	8	17	10.1	23.0	12.5	51.3
Total errors arising with the use of COMPUSTAT	5	4	9 (5.3)	18.7	54.9	15.1	97.1
Total errors arising with the use of Value Line	14	12	26(15.2)	11.6	24.5	14.5	53.7

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* The differential is the difference between the HC and CC amounts. A differential understatement (overstatement) means that an IFCO differential computed using HC data from COMPUSTAT or Value Line and CC data from the FAS 33 Data Bank is less than (greater than) the true IFCO differential in the FAS 33 footnote to the annual report.

** From a sample of 171 firms.

*** The amount of the error expressed as a percentage of the true differential (i.e., as contained in the annual report).

fields off Compustat and one field off Value Line. Compustat field 14 is the reported or inferred income statement amount and field 125 is from the statement of changes in financial position (SCFP). Value Line's field 14 is also an SCFP amount, but sometimes does not agree with Compustat's field 125, so each was tested independently.

Results

Failure to reconstruct the differential by using the FAS 33 tape in conjunction with Compustat or Value Line is defined as an error (from the researcher's perspective). Table 1 categorizes and summarizes, by year, IFCO errors for the sample of 171 firms. Some errors result regardless of the researcher's choice between Compustat and Value Line, while other errors depend upon that choice. The overall error rates vary by year, with 1980 the lowest and 1981 the highest. In every year, use of Compustat results in a lower error rate in reconstructing the IFCO differential than Value Line, with the most pronounced difference occurring in 1982.

A significant number of the IFCO errors in 1981 are caused by firms that reported HC on the income statement under FAS 52 [FASB, 1981] but reported HC in the supplementary disclosure under FAS 8 [FASB, 1975]. The data collectors apparently allowed for this possibility when they set up field NCR42 (an indicator variable) which, for 1981, denotes application of FAS 52 in the FAS 33 footnote. However, errors in this field prevent its usefulness as a screen by the researcher.[6]

Table 2 reports the size and materiality of the errors in reconstructing the DEPR differential using each of the three alternative fields for historical cost depreciation. Note that there is a marked tendency to understate, rather than overstate, the differential. Although the use of Value Line results in a lower rate of error in reconstructing the depreciation differentials than either of the Compustat fields, all error rates are surprisingly high. Subsequent investigation for 1982 revealed that five percent of the sample firms contain an incorrect amount of DEPRCC in the FAS 33 data bank (i.e., coding errors). An additional 15 percent of the sample firms reported an amount of DEPRHC in their supplementary disclosure that did not correspond to the depreciation reported in their income statement or SCFP. For most of the remaining firms with errors in 1982 (between five percent and 13 percent of the sample, depending on which DEPRHC is used), one of the historical cost depreciation fields would result in the correct differential, but *a priori*, the researcher does not know which to choose for a particular firm. (See Vasarhelyi and Yang [1983] for a discussion of the differences between depreciation fields on Value Line and Compustat.)

One type of error not included in Tables 1 and 2 exists for those companies that rounded off both IFCOCC and IFCOHC (DEPRCC and DEPRHC) in their supplementary disclosures to the nearest million dollars. A reconstructed differential may be in error by as much as $490,000, when the rounded IFCOCC (DEPRCC) is compared to the nonrounded IFCOHC (DEPRHC). Also not included in the tables was the failure of the data bank to report IFCOCC for one sample firm in 1981 and another in 1982, as well as DEPRCC for one firm in 1981 and four firms in 1982.

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[6] For four of the ten sample firms using FAS 8 in the supplementary disclosure, field NCR42 indicates use of FAS 52. Also, NCR42 contains a zero for 137 of the 171 firms in the sample, presumably indicating non-use of FAS 52 in the supplementary disclosure. A user cannot determine without substantial additional work, however, whether these firms used FAS 8 or did not have foreign operations.

TABLE 2

ERRORS RESULTING FROM USE OF CURRENT COST DEPRECIATION FROM FAS 33 DATA BANK IN CONJUNCTION WITH HISTORICAL COST DEPRECIATION FROM COMPUSTAT OR VALUE LINE

		Frequency			*Materiality*			
					Median Understatement		*Median Overstatement*	
Historical Cost Depreciation from	*Year*	*Number of Differential* Under-Statements*	*Number of Differential* Over-Statements*	*Total Number of Errors (%)***	*$ (Millions)*	*Percent****	*$ (Millions)*	*Percent****
COMPUSTAT Data Item 14	1979	49	13	62 (36.3)	2.3	13.8	1.0	9.8
	1980	37	22	59 (34.5)	8.2	13.6	3.8	5.8
	1981	43	25	68 (39.8)	4.1	13.7	1.0	5.7
	1982	31	23	54 (31.6)	4.4	17.4	2.8	7.8
COMPUSTAT Data Item 125	1979	59	6	65 (38.0)	3.5	14.8	6.5	14.8
	1980	52	5	57 (33.3)	3.4	13.1	13.4	32.8
	1981	58	9	67 (39.2)	3.2	13.3	.6	5.6
	1982	57	2	59 (34.5)	3.2	16.7	231.3	109.4
VALUE LINE Field 14	1979	37	9	46 (26.9)	4.4	15.4	9.9	60.0
	1980	31	9	40 (23.4)	3.3	15.9	21.9	72.0
	1981	45	11	56 (32.7)	3.2	11.9	2.6	5.6
	1982	41	4	45 (26.3)	3.0	16.7	481.1	86.4

* The differential is the difference between the HC and CC amounts. A differential understatement (overstatement) means that a differential computed using HC data from COMPUSTAT or Value Line and CC data from the FAS 33 Data Bank is less than (greater than) the true differential computed using data reported in the FAS 33 footnote to the annual report.

** From a sample of 171 firms.

*** The dollar error divided by the true differential.

SUMMARY AND IMPLICATIONS

This study examines the ability of a researcher to reconstruct the differences between current cost and historical cost IFCO and DEPR found in firms' annual report supplementary disclosures, by using current cost data from the FAS 33 data bank in conjunction with historical cost data from either Compustat or Value Line. Error rates for the income differential are lower using Compustat than Value Line. However, even if Compustat is used, the error rate for IFCO in 1981 of 12.9 percent seems to necessitate a manual checking of the 1981 annual reports by the researcher. Failure to do so may prevent the researcher from capturing small, though material, information effects.[7] The error rates for reconstructing the depreciation differential range from 23.4 percent to 39.8 percent. Such high rates would seem to preclude using the data bases without manually checking annual reports to correct the differentials. Furthermore, the bias toward understatement of the depreciation differential may reduce the power of empirical tests, since the directional effect is consistent with a null hypothesis of no incremental information effect for current cost depreciation.

These errors are from two sources: 1) data collection errors in either the FAS 33, Compustat, or Value Line data bases, and 2) compatibility errors caused by the FASB's decision to rely on an independent data base for historical cost data. The latter type of error results when the HC data from the supplementary disclosure do not agree with HC data from Compustat or Value Line. It is caused by the design of the FAS 33 data base and cannot be remedied by simply reporting coding errors to the FASB.

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[7] Researchers testing for information content also need to consider another error noted by S & B [1984, p. 471]: the miscoding of the variable used to indicate that the 1979 data were first reported in the 1980 report. That variable was in error for nine of the 171 firms in our sample.

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EDUCATION RESEARCH

Frank H. Selto, Editor

Empirical Accounting Research Design For Ph.D. Students

William R. Kinney, Jr.

ABSTRACT: This paper discusses an approach to introducing empirical accounting research design to Ph.D. students. The approach includes a framework for evaluating accounting experiments as well as studies based on passive observation of subjects or data. Alternative methods of isolating the effect of the "independent" variable of interest from effects of prior-to-the-study-period variables and contemporaneous variables are discussed along with the advantages and limitations of each method. Also discussed is the relationship between type I and type II error risks, sample size, and research design. The importance of research design, including theory development and means for mitigating the effects of extraneous variables, is emphasized as perhaps the only practical way to achieve research objectives in empirical research in accounting.

A FREQUENTLY encountered problem in accounting Ph.D. programs is that first-year students do not have background in empirical research in accounting. Few B.B.A., M.B.A. or M.Acc. programs include courses in empirical research and many students have not seriously considered its nature. Yet, such an introduction is necessary if Ph.D students are to efficiently relate other courses to substantive problems in accounting and be able to take full advantage of accounting workshops.

The purpose of this paper is to show how a basic framework for evaluating empirical research in accounting can be obtained in a short introduction. This can be done at the start of the first term course and provides a context for further work in philosophy of science and statistical design as well as substantive areas of accounting. The approach is generic—it is not tied to an area of accounting and doesn't depend on prior knowledge of a particular paradigm.[1]

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[1] Illustrations and extensions from applied areas of accounting are also helpful. Good sources for financial accounting are Ball and Foster [1982], Lev and Ohlson [1982], and Abdel-khalik and Ajinkya [1979]. Good sources for behavioral work are Ashton [1982] and Libby [1981].

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The generic approach focuses attention on the essence of scientific inquiry in accounting. Many of the problems faced by accounting experimenters who can manipulate some (but not all) of the levels of variables to be studied are similar to those faced by "passive observers" of the levels of all variables as set by Nature.[2] Thus, the generic approach may help to avoid premature specialization [Boulding, 1956, p. 199].

Section I presents a definition of empirical accounting research and theory, hypothesis, and fact. It also defines "dependent," "independent," and prior and contemporaneous influence variables. Section II discusses alternative means for separating the effects of prior and contemporaneous influence variables from the independent variable(s), and in Section III the interrelationships among significance, power, and research design are explored. Section IV gives a summary and conclusions.

I. A FRAMEWORK FOR EMPIRICAL RESEARCH IN ACCOUNTING

Research is a purposive activity and its purpose is to allow us to understand, predict, or control some aspect of the environment. Research will be defined here as *the development and testing of new theories of 'how the world works' or refutation of widely held existing theories.* For accounting research, the theories concern how the world works with respect to accounting practices. Watts and Zimmerman [1984, p.1], state: "The objective of accounting theory is to explain and predict accounting practice." This positive, how-the-world-is approach is in contrast with the more traditional normative view that accounting "theory" is concerned with what accounting practices *ought to be.*

Empirical accounting research (broadly considered) addresses the question: "Does how we as a firm or as a society account for things make a difference?"[3] Clearly, the accounting for items affecting tax payments makes a difference in our individual and collective lives. But does the accounting for, say, depreciation in internal or external reports affect decisions within a business firm or affect stock prices? If it does, then the size of the effect and why it occurs are important follow-up questions. Additionally, the accounting researcher must separate the underlying economic event (or state) from the accounting *report* of the event. Thus, while a finance researcher may be concerned only with firm characteristics, the accounting researcher must also be concerned with the costs and benefits of alternative accounting reports of those characteristics.[4]

In essence, empirical research involves *theory, hypothesis,* and *fact.* "Facts" are states or events that are observable in the real world. A "theory" offers a tentative explanation of the relationship between or among groups of facts in general. "Hypotheses" are predictions (or assertions) about the "facts" that will occur in a particular instance assuming that the theory is valid. Finally, observing "facts" consistent with the prediction or assertion made in the hypothesis lends credibility to the theory.

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[2] The problems are not identical. For example, while experimenters have the advantage of being able to specify the values of some variables, they also face the risk of choosing values that are too close together (or too far apart) to allow precise estimates of treatment effects or to allow generalization of conclusions to the real world.

[3] Within this definition, relevant questions for auditing include, "Does how precisely we audit and report the state of a firm make a difference?" and, "How can audits of a given precision be conducted efficiently?" The first auditing question is related to the accounting question through the concept of materiality. Parallel questions involving the design of accounting systems also could be developed.

[4] Accounting professors may conduct research in finance, economics, behavioral science, or statistics. If the accounting question is not addressed, however, the accounting professor may face the disadvantage of being undertrained relative to other researchers. Also, he or she ignores a comparative advantage in the knowledge of accounting institutions and the sometimes subtle role of information.

Ordinarily, research begins with a real-world problem or question. One thinks about or studies the problem, reads about seemingly similar problems in other areas or disciplines such as economics, psychology, organizational behavior, or political science. By immersing himself or herself in the problem, the researcher may, either by genius or by adapting a solution from another area, develop a general theory to explain relationships among facts [Simon, 1976, Chapter 7 and Boulding, 1956]. From this statement of the general relationship among facts, hypotheses about what should be observed in a particular situation can be derived. An experiment or passive observation study then can be designed to support or deny the hypotheses.

For example, suppose it is observed that a stock price increase usually follows the announcement that a firm has changed from straight-line to accelerated depreciation. Why should a mere bookkeeping change seem to lead to an increase in firms' values? An explanation might be that market participants believe that events leading to such an accounting change also typically lead to better prospects for the firm in the future. With development and elaboration of such a theory, the researcher might develop a passive observation study of past changes or an experiment to test hypotheses based on the proposed explanation.

Theories are usually stated in terms of theoretical variables or "principals" while empirical measurement requires observable variables. The difference between the principal and real-world observable variables presents difficulties for accounting researchers since accounting measurements may be either *surrogates* for some underlying principal of interest or may be the *principal* itself. For example, if firm "performance" is the theoretical principal and earnings is chosen as the surrogate measure of firm performance, then straight-line depreciation is a component of the surrogate.

As a surrogate, straight-line depreciation contains two sources of potential error that may require consideration by the researcher. One is the surrogation error due to the fact that straight-line depreciation does not "correctly" reflect the relevant performance of the firm for the purpose at hand. The other is application error due to mistakes or imprecision in applying straight-line depreciation.

On the other hand, in evaluating possible determinants of managerial behavior, audited earnings using straight-line depreciation may be specified in a contract and may serve as a principal. For example, if a manager is to receive a bonus or profit share of one percent of audited earnings, then audited earnings is the principal. Surrogation error, and any application error not detected and corrected by the auditor, is *ignored* for contract purposes. The same number used as a measure of firm performance will likely contain both surrogation and application error.[5]

To add credibility to a theory, one must not only be able to show hypothesis test results that are consistent with the theory's predictions, but also have a basis to rule out alternative explanations of the observed facts. This requires consideration of a reasonably comprehensive list of alternative explanations. Again, knowledge of related disciplines is useful in generating alternative explanations for accounting-related "facts." Some possible explanations can, of course, easily be ruled out as being of likely negligible effect, but others will require attention.

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[5] Accounting systems' designers and financial accounting standards setters can control the first type of measurement error, while auditors and auditing standards setters can control the second. Problems relating to the interaction of accounting and auditing standards setters, users, and auditors is, of course, a matter for accounting research.

To be more specific, let Y denote the "dependent" variable to be understood, explained, or predicted. Variables causing Y (or at least related to Y) can be classified into three broad groups as follows:

X = the "independent" variable that the proposed theory states should effect Y,
Vs = prior-influence (prior-to-study period) factors that may affect Y, and
Zs = contemporaneous factors (other than X) that may affect Y.[6]

That is, $Y=f(X,V_1,V_2,\ldots,Z_1,Z_2,\ldots)$.

A common Y for addressing an accounting question is the change in a firm's stock price. Others are a manager's act or decision. A common X is a change or difference in accounting method, whether by management's choice or by a regulatory directive. Prevalent Vs are the firm's prior period state variables such as profitability, leverage, liquidity, and size. For tests of theories about decision-making behavior of particular human subjects, relevant Vs often include the subject's personality traits, mathematical ability, education, training, age, firm association, and experience.

The most common Z factor in accounting research studies involving stock prices is the market return (Rm). Another common group of Zs for external reporting and managerial performance studies is the unexpected portion of contemporaneous accounting measures for other firms or other divisions. Finally, since the accounting researcher is concerned with the effect of accounting reports, Zs may be underlying characteristics of the "true state" of the firm at the time of the study as measured by contemporaneous nonaccounting reports about the firm.

DISENTANGLING THE EFFECTS FROM Vs AND Zs FROM THE EFFECT OF X

For simplicity, assume that X is measured at only two levels. Either the observed Y is from the "control" group that receives no "treatment" or from the treatment group that receives the treatment. Alternatively, the two groups could simply be different on some relevant dimension (e.g., to test theories about accelerated depreciation, the control group might be defined as those firms that use straight-line and the treatment group as those that use accelerated).

Also for simplicity, assume that there is a single prior-influence factor V that effects Y and V has the same effect on Y whether the subject is from the control or treatment group. Furthermore, there are no contemporaneous Zs that affect Y and the model determining Y is:

$$Y_{ij}=B_0+B_1X_i+B_2V_{ij}+e_{ij}, \qquad (1)$$

where Y_{ij} is the value of the dependent variable for the "j"th subject in the "i"th treatment, B_0 is the intercept for the control group, X_i is an indicator variable (zero for the control group and one for treatment), B_0+B_1 is the intercept for the treatment group (that is, B_1 is the effect of treatment), B_2 is the regression coefficient relating V to Y, and e_{ij} is a random error term. The e_{ij} term will include the effects of other Vs and Zs that are here assumed to be negligible and randomly distributed between the two groups, and e_{ij} is assumed to have expectation zero and be uncorrelated with either X or V.

For the simple model of equation 1, a plot of the expected values of Y given V for both groups will be parallel lines with possibly different intercepts. The difference in intercepts is the effect of the treatment (B_1). Figure 1 shows the components

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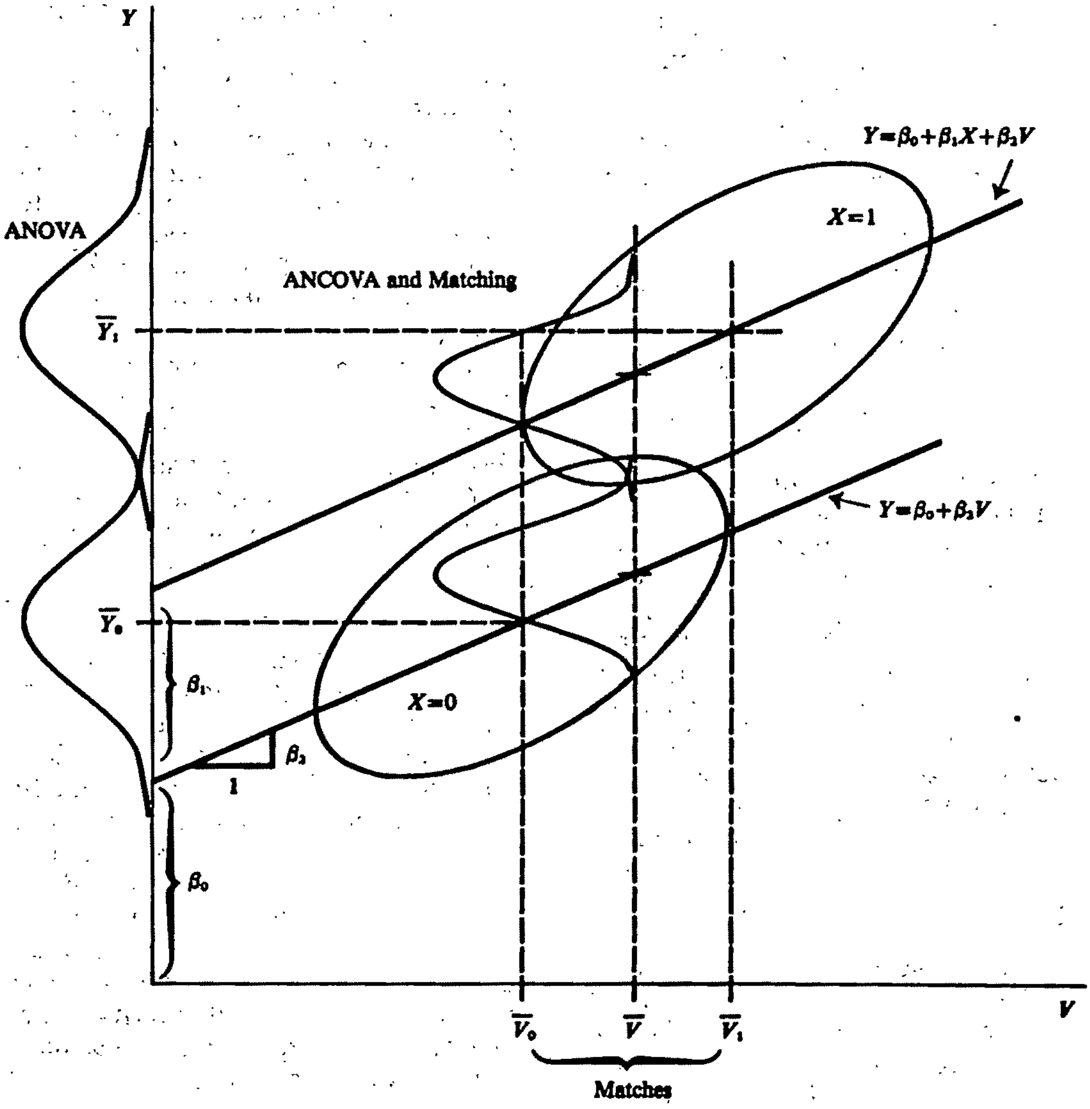
[6] Some Zs may be expectations, at the time of the study, of still future values of X, Y, V, and other Zs.

FIGURE 1

Y VALUES FOR NONEQUIVALENT GROUPS UNDER ANOVA, ANCOVA, AND MATCHING



of equation 1 along with ellipses that approximate the locus of members of the two groups.

An experimenter may ignore V and may randomly assign subjects to groups. On average, the groups will be equivalent on V. For small samples, however, there is nontrivial risk that such a procedure may assign to the treatment group, say, those with high values of V and to the control group those with low V. In analyzing results, the effect of the high V values (i.e., B_2V_{ij}) will be mixed with the treatment effect. An experimenter may rule out the possible effect of V by random assignment of subjects measured on V

between groups. The sample subjects are measured on V, matched into pairs according to their V values, and one from each pair is randomly assigned to treatment. Thus, even for small samples the two groups will be approximately equivalent on V.

The passive observer has no opportunity to randomly assign sample subjects to treatment. Even experimenters may have difficulty developing a satisfactory randomized design due to having too many potentially important Vs and Zs that must be simultaneously matched. Thus, in general, researchers face the problem of treatment groups that are not equivalent with respect to V.

For nonequivalent groups, there are three basic ways in which the researcher can mitigate the possible effects of the V factor in the model of equation 1. These are:

1. ignoring V (i.e., assuming or hoping that V is randomized with respect to X),
2. matching on V *ex post* (i.e., matching after X has been chosen by the subject or assigned by Nature), and
3. using covariance analysis to statistically estimate and remove the effect of V.

The first approach ignores V, and results can be analyzed with a single-factor analysis of variance (ANOVA). The second approach physically equates the treatment groups with respect to V, and results can be analyzed using a randomized block design. The third approach "statistically" equates the groups, and results can be analyzed using analysis of covariance (ANCOVA).

Each of these approaches is discussed in turn, along with some of the advantages and limitations of each for experimenters and passive observers.

Ignoring V

As discussed above, ignoring a potential V is generally inadvisable due to the unknown effect of V. A negligible effect is the *hoped for* result for any unmatched, unmeasured, or unknown Vs or Zs. However, most real-world events have multiple causes and a negligible overall effect is unlikely. Furthermore, larger samples will not help in research designs that ignore systematic effects of V.

While *ex post* matching and covariance analysis can't account for all possible Vs and Zs, they can reduce the risk that some potentially important Vs and Zs disguise the true effect of X. Figure 1 shows the relevant sampling distributions for the three approaches applied to the example. As shown in the relatively flat distributions on the left margin, ANOVA is based on the marginal distribution of Y with no consideration of V.

Ex Post Matching

In many situations, the researcher selects a sample after the phenomenon of interest has taken place. Often, the researcher selects a sample of subjects from the treatment group and then selects a subject from the control group with V equal or similar to V for each treatment subject. This *ex post* matching on V is probably the most commonly used design for passive observational studies in accounting.

For *ex post* matching, the model assumed to determine Y is:

$$Y_{ij} = B_0 + B_1 X_i + \sum_{j=2}^{m} B_j M_j + e_{ij}, \qquad (2)$$

where B_0 is the overall mean of Y plus the effect of (arbitrarily designated) match 1, B_j (for $j > 1$) is the differential effect of match j compared to match 1, M_j is an indicator variable (equal to one if the sample subject is a member of match j and zero otherwise), and *m* is the number of matches.[7]

For passive observational studies, it is impossible to randomly assign subjects to treatments since by definition the subjects have already either "self-selected" into treatment groups, or have been so selected by Nature. It is possible that there will be few or even *no* matches. For example, all the firms using straight-line depreciation may be small firms and all firms using accelerated depreciation may be large. A firm's choice of accounting method (or decision to change methods) may merely reflect its V value. Figure 1 illustrates such a possibility in that only the bottom half of group 1 can be matched with a member of group 0 due to the difference in V for the groups.

Even experimenters using *ex ante* matching with random assignment of subjects often face the lack-of-matches problem for at least some Vs and Zs. Suppose, for example, that a researcher believes that an auditor's response in a professional task experiment may be related to the auditor's professional training (X) after accounting for his or her mathematical abilities (V). It may be difficult to match subjects from different firms based on mathematical abilities. This is because firms may hire and thus train (or students may choose firms and be trained) on the basis of mathematical ability.[8]

As will be discussed below, the efficiency of matching may be less than that for covariance analysis. However, *ex post* matching is likely to be superior to covariance analysis when the functional form of the $Y|V$ relationship is nonlinear or unknown. Given that the treatment effect is not correlated with V, matching can be used for any functional form of Y and V (known or not) and analyzed using a blocked design.

Covariance Analysis

A researcher using analysis of covariance (ANCOVA) statistically estimates the effect of V on Y and removes it. ANCOVA can be viewed as the result of projecting observed Y values along the regression line to a common point on the V axis, such as $\bar{V}$, to yield the conditional distributions as shown in Figure 1.[9]

Figure 1 shows that part of the difference between the marginal distributions of $\bar{Y}_0$ and $\bar{Y}_1$ (as estimated using ANOVA) is due to a larger $\bar{V}$ for the treatment group. Matching (equation 2) accounts for the difference by subtracting $\hat{B}_0+\sum \hat{B}_j M_j$ from Y for each subject, and ANCOVA accounts for the difference by subtracting $\hat{B}_0+\hat{B}_2 V_{ij}$ from Y for each subject. Thus, both matching and ANCOVA are seen to mitigate the differential effect of V. Figure 1 also shows that control group subjects with relatively high V for the control group are matched to subjects with relatively low V for the treatment group. For matched designs, all other potential sample subjects must be omitted due to lack of matches.

Matching and ANCOVA yield more efficient (more precise) estimates of the treatment effect than does ANOVA. In general, however, it is unclear which of the two will be more precise. This is due to the fact that while the difference in $\bar{V}_0$ and $\bar{V}_1$ reduces the precision of ANCOVA, the reduction in sample size due to lack of matches reduces precision for matching.

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[7] The matches may be by individual subject ("precision" or "caliper" matching) as discussed above, or by frequency distribution (e.g., equal mean and variance with respect to V for both groups). A test of equality on V is often used as a justification for ignoring V in the statistical analysis.

[8] An alternative design is to limit all subjects in an experiment to a fixed level of V. This equalizes the effect of V but greatly reduces the generalizability of results over the range of reasonable V values that might occur.

[9] The sampling distributions for matching and ANCOVA are shown as the same in Figure 1 since the expectations of estimates of the treatment effects are the same for both. As discussed, however, their standard errors will differ.

It is often difficult to predict which will be the greater problem.[10]

Equation 1 and Figure 1 present a very simple situation even for a single V. For example, the $Y|V$ relationship may differ depending on whether X is at level zero or one. Furthermore, the occurrence of a given level of V at time t-1 may have a direct effect on Y at time t but may also affect the level of X at time t which, in turn, affects Y at t. Thus, there may be two paths by which V affects Y. A complete approach would include a model of the "selection" process by which V affects X as well as the direct effects of X and V on Y.[11]

III. ALPHA, BETA, SAMPLE SIZE AND RESEARCH DESIGN

Planning research to disentangle X, Vs, and Zs involves four related factors. These are alpha (α), beta (β), sample size, and what will be called the "research design" factor (denoted D). In a given situation, setting any three of them sets the fourth. The statistical factors of α (the probability of a type I error or incorrectly rejecting a true null hypothesis of no treatment effect), β (the probability of a type II error or not rejecting the null hypothesis when, in fact, there is a treatment effect), and sample size are well known. The research design factor is the ratio of two subfactors. Its numerator is the hypothesized magnitude of the (X) treatment effect (denoted δ), and its denominator is the standard deviation of the residuals in the equation used to estimate B_1 (denoted σ). Thus, $D=\delta/\sigma$. The numerator depends on the researcher's theory, and the denominator depends on how the researcher disentangles the Vs and Zs and the inherent variability in the phenomenon under examination.

The required sample size is a decreasing function of α, β, δ and an increasing function of σ. Therefore, for a given α and β, the required sample size will be small if the proposed theory implies a large effect on Y and/or the researcher is clever in designing a plan to disentangle the effects of the Vs and Zs. For example, using ANOVA (no matching) in a single test with target $\alpha=.05$, $\beta=.1$, and $D=\delta/\sigma=.5$, the required sample size is 70 for each of the two groups.[12] If the researcher has a theory yielding a larger δ that would increase D to .75, then the sample would be 32 each, and if D is 1.0 then the sample size is 18 per group. Alternatively, for $D=.5$ and holding δ constant, if matching is used and the Y_0, Y_1 correlation is .25 then the required sample is approximately 57 pairs.[13] If the Y_0, Y_1 correlation is .5 (implying a reduction in σ of about 18 percent), then the required sample is 36 pairs.

The four factors and their implications for accounting research will be discussed through two subtopics. These are: 1) power, and 2) prejudice against the null hypothesis.

Power

Consider a researcher who has a theory that the treatment effect (B_1) is positive, and who therefore is interested in testing the (null) hypothesis that the true effect of treatment is less than or equal to zero against the alternative that the true effect

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[10] ANCOVA will usually be less biased, however (see Cook and Campbell [1979, pp. 177–182], and Cochran [1983, pp. 127–128]).

[11] See Cochran's comments on R. A. Fisher's advice to "Make your theories elaborate." According to Cochran, Fisher meant that when "constructing a causal hypothesis one should envisage as many different consequences of its truth as possible, and plan observational studies to discover whether each of these consequences is found to hold" [Rosenbaum, 1984, p. 43]. This advice is consistent with Boulding's exhortation to develop and test theories that are at the level of the real world.

[12] The required sample size is:

$$n=2[(t_{\alpha,2n-2}+t_{\beta,2n-2})\,(1/D)]^2$$

See Ostle [1963, p. 553] for a table.

[13] The required sample size is:

$$n=[(t_{\alpha,n-1}+t_{\beta,n-1})\,(1/D)]^2$$

See Ostle [1963, p. 551] for a table.

is greater than zero. Assume that a sample of treatment subjects has been matched or "paired" on V with control subjects. Also, based on an assessment of the appropriate significance level for the issue at hand, the researcher has set α at .05, and the researcher has a research design in mind.

What the researcher may not consider at the planning stage is the magnitude of the hypothesized effect (i.e., a particular δ for the alternative hypothesis) and the allowable β for that δ.[14] A δ may not be considered since most theories suggest only the direction of an effect and not its magnitude, and β is not considered because no particular δ is specified. The researcher may proceed to testing with little consideration of whether the planned test has an adequate chance to reject the null hypothesis even if it is false.

To illustrate, consider the sampling distributions in Figure 2. For both panels of Figure 2, the left-hand distribution is for the mean of the paired differences if the null hypothesis ($B_1=0$) is true, and the right-hand distribution applies if the particular alternative ($B_1=\delta$) is true. Also for both panels, k is the point that yields $\alpha=.05$ or five percent of the area to the right of the point under the left-hand distribution (i.e., H_0). In panel a, the research design and sample size yield a sampling distribution with a large area $(1-\beta)$ to the right of k under the alternative hypothesis. Thus, there is high probability of rejecting H_0 when the alternative hypothesis is true. In other words, the power of the test $(1-\beta)$ is high.

In Figure 2, panel b, δ is the same as in panel a, but the sampling distributions are much flatter due either to small sample sizes or a large standard deviation due to remaining effects of Vs and Zs. Rather than the relatively high power test of panel a, the researcher faces a low power test. At $\alpha=.05$, β for the simple alternative hypothesis is greater than .5, and power is less than .5. Even if H_0 is false (i.e., $B_1=\delta$). and thus the researcher's theory of a positive treatment effect is correct, the researcher has a *less than even chance* of rejecting it!

Suppose that the researcher in panel b observes a test statistic that is almost significant, and the sample estimate of the treatment effect is equal to δ. He or she then decides to take a follow-up sample. The follow-up sample is also likely to indicate nonrejection due to its small size [Tversky and Kahneman, 1971, p. 107].

The real culprit, of course, is the low power of the test. If the low power is anticipated at the planning stage, an attempt can be made to mitigate its negative effects or else abort the project. In general, power can be increased by 1) increasing the sample size, or 2) increasing the design factor D by developing better theories (yielding larger δ) or by making better use of a given sample size and theory by careful attention to the Vs and Zs (yielding smaller σ).

As a practical matter, improved design is often the only alternative in accounting research since the size of samples in accounting frequently is effectively *fixed*. For experiments, the pool of available auditors, accountants, financial statement users, and even students is effectively limited to fairly small numbers. Subjects' time is not free, and the supply is not inexhaustible. For passive observation, the number of firms for which particular accounting and other required economic data are available may be relatively small. Thus, accounting researchers need to be aware of a variety of analytical techniques appli-

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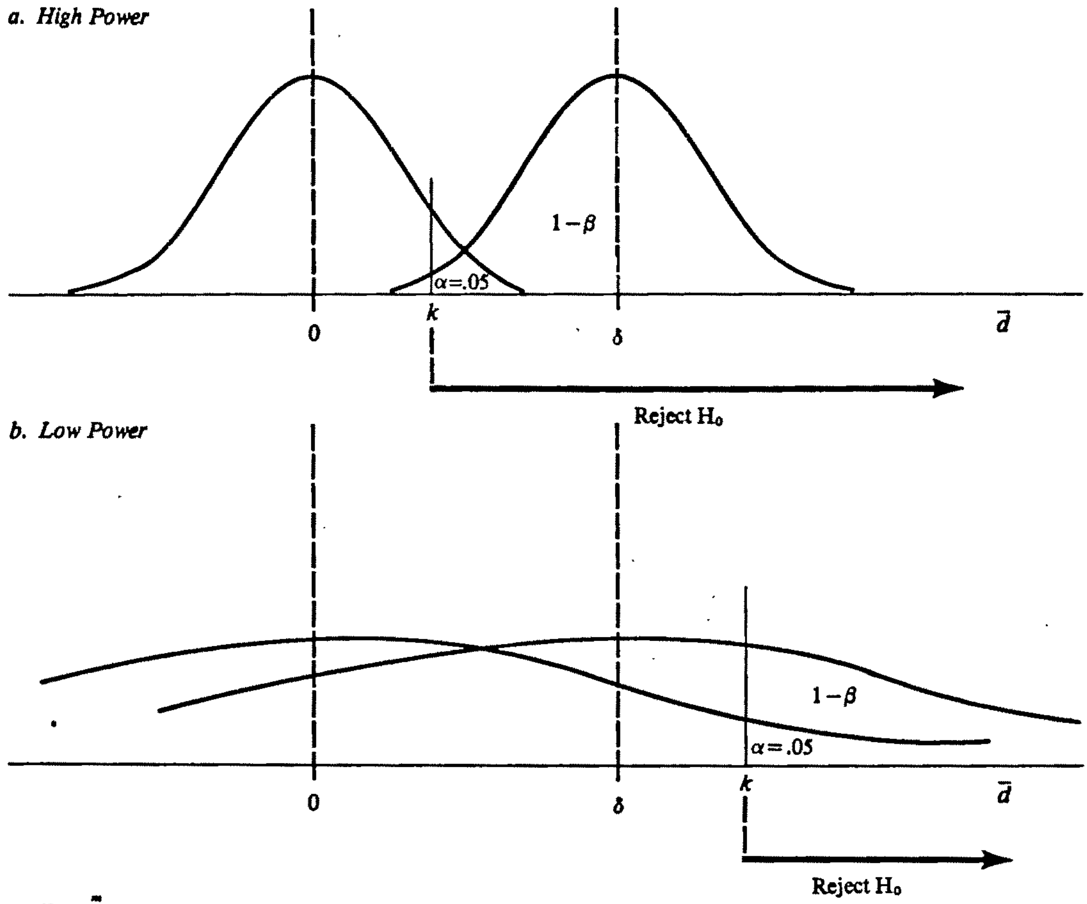
[14] See Tversky and Kahneman [1971]. This is in contrast to classical or normal distribution theory-based audit sampling where, in addition to setting α to control the risk of incorrect rejection, the auditor sets β to control the risk of incorrect acceptance and sets δ based on "intolerable" error (materiality). The auditor then selects an estimator and calculates the minimum sample size subject to the target α, β, and δ.

FIGURE 2

SAMPLING DISTRIBUTIONS OF $\bar{d}$ * FOR HIGH AND LOW POWER TESTS



$* \bar{d} = \sum_{j=1}^{m} (Y_{ij} - Y_{0j})/m.$

cable to a variety of research problems.[15]

Furthermore, for a given research paradigm, the problem of low power is likely to become more difficult over time. Other things equal, as knowledge of the effects of accounting expands, the likely size of the effect of each new or more refined theory (B_1) will tend to have less additional explanatory power. As knowledge expands, the best potential Xs are investigated and become Vs or Zs. For example, early studies tested hypotheses about the degree of owner *versus* manager control as an X that affected accounting choices. Later studies have used the same variable as a V or Z. Absent developments that restructure the way a particular problem is addressed, future researchers will be faced with discovering new Xs that have less potential explanatory power.

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[15] In debate on the preferability of parametric vs. nonparametric statistics in research, the ability of parametric methods to accommodate more Vs and Zs through covariance analysis is an often overlooked advantage.

In fact, it may be unreasonable to expect that a particular theory based on accounting methods will yield a true differential effect that is very large relative to the variance of Y. How things are accounted for simply can't be expected to explain a large portion of stock price variability or managerial or investor behavior. Under some conditions, the sample size required to yield reasonable power exceeds the size of the known population!

A researcher can get some protection by making a tentative calculation of power before investing in expensive data collection or in experimentation. For example, passive observers of accounting changes and stock returns may be able to make reasonable estimates of the standard deviation of return residuals and might make power estimates for various levels of δ.[16] If the estimated power is inadequate even for the maximum δ that might reasonably exist, then the research can be redesigned or aborted. Experimenters are perhaps more familiar with prospective power calculations and frequently use a pilot sample to assist with the sample size and research design development.

Prejudice Against the Null Hypothesis

A theory usually specifies the direction of the treatment effect and a researcher generally sets out to reject hypotheses based on the assumption that the treatment effect is zero or in the opposite direction from what the theory predicts. The focus on rejecting the null hypothesis is the source of a number of "biases" against the null that may lead to dysfunctional consequences. Greenwald [1975] lists eight such consequences; four that seem most important for accounting researchers are discussed in order to be better able to avoid them.

1. A paper will not be submitted for publication consideration unless the results against the null are "significant." Especially interesting or innovative results may be submitted on higher than .05 significance (or alternatively, the probability at which the results are significant are reported), but rarely does an editor see results with significance levels above .15. This prejudice need not exist if not rejecting the null gives reasonable credibility to the null.[17]
2. Ancillary hypotheses will be elevated in the exposition of results. Secondary hypotheses that are significant *ex post* will receive more attention than other secondary hypotheses and perhaps the primary hypotheses. Suggestions will be made that these results warrant further study, when in fact one would expect about one in ten nonsense relationships to be significant at the .10 level.
3. Alternative operationalization of variables or their functional form will be conducted only if "preliminary" results are insignificant. The extent to which this search activity is justified is open to debate since most theories don't imply a single measurement or functional form.
4. The search for errors will be asymmetric. Outliers that impede rejection of the null hypothesis will tend to receive more diligent attention than those that favor rejecting the null. If significant results are

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[16] The choice of δ is somewhat arbitrary, but in planning it is useful to consider reasonable or plausible values for the true treatment effect of X. Alternatively, one might choose the smallest effect that informed persons would agree is empirically "important" and therefore worth knowing about if it exists, or the largest amount that one could reasonably expect.

[17] In classical statistics, not rejecting the null is not equivalent to accepting the null. However, non-rejection by a reasonably powerful test or series of tests does increase one's subjective degree of belief in the null.

obtained on the first analysis of a problem, the neophyte researcher may not consider a search for outliers or for other violations of statistical assumptions underlying the analysis. Nonrejection may lead one to consider such explanations and to search for programming errors and data coding errors.

V. SUMMARY AND CONCLUSIONS

In this paper we have stressed consideration of planning for *V*s and *Z*s to be able to isolate the effect of *X* as a potential explanation of differences in *Y*. This consideration may allow increased power in tests and may allow more to be learned from a given sample. Planning for *V*s and *Z*s can reduce the risk of not rejecting the null hypothesis when it is false. Such planning may also allow a basis to argue that nonrejection of the null hypothesis may support *acceptance* of the null. That is, if the treatment has an important effect, then it should be revealed by the test. Thus, something may be learned whether results are statistically significant or not. This should increase the objectivity of the researcher, since the work is valuable whatever the empirical results.

There are at least two ways in which the approach discussed in this paper can be useful to Ph.D. students. One is in evaluating the research design of others, and the other is in planning the student's dissertation.[18] Students must evaluate the work of others whether in published articles, working papers, or accounting research workshops. A student applying the approach to the work of others might try to answer the following questions: What is the *Y* and what is the *X*? What *V*s and *Z*s are considered? Are there better ways to account for the effects of *V*s and *Z*s? What are other *V*s and *Z*s that might have important effects?

The same approach can be applied by the student to his or her own dissertation proposal. While the basic development of a research proposal is the responsibility of the student, there is much to warrant early faculty discussion of *planned* dissertation research. That is, the faculty can evaluate a proposal by considering the reasonableness of the theory and the adequacy of control of potential *V*s and *Z*s. The faculty should be asked: Is the magnitude of the hypothesized effect plausible? Are all important competing explanations listed and adequately dealt with in the plan? Will the proposed tests likely uncover evidence of a difference equal to δ if it exists? Will nonrejection lend credibility to the null?

Faculty approval of planned dissertation research reduces the student's risk by 1) ruling out potential topics that have little chance of successful completion, 2) gathering the right data on the first attempt, 3) eliminating outcome dependence (thus reducing moral hazard for the student), and 4) reducing the temptation of the student (and faculty) to pursue numerous tangents that may come to light as the research progresses.

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[18] In planning research or evaluating the research of others, a useful practice is to give early attention to the *purpose* of the research through preparation of a three-short-paragraph abstract, synopsis, or working model of the research. The first paragraph answers the question "What is the problem?" The second asks, "Why is it an important problem?" and the third, "How will it be solved?" Alternatively, the questions might be: "What are you (or the researcher) trying to find out?", "Why?", and "How will it be done?"

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BOOK REVIEWS

Harvey S. Hendrickson, Editor

EDITOR'S NOTE: Books for review should be sent to Professor Harvey S. Hendrickson, School of Accounting, College of Business Administration, Florida International University, Miami, FL 33199.

(The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.)

Accounting for Portfolio Investments: A Research Study (Toronto: The Canadian Institute of Chartered Accountants, 1984, pp. xiv, 134, Can. $19.50 paper).

This study is one in a series of research studies commissioned by the Research Department of the Canadian Institute of Chartered Accountants. A group of practicing chartered accountants (the Study Group) were the authors of this monograph. Their basic objective was to review the current practices related to accounting for portfolio investments and determine whether some method(s) can provide a degree of consistency in accounting for these securities.

For purposes of the research, the Study Group defined portfolio investments fairly narrowly to include fixed-term and equity securities, excluding "nonpassive investments such as investments in subsidiaries, joint ventures, partnerships and companies subject to significant influence by the investor" (p. xiii). To carry out its research, the Study Group examined relevant literature, surveyed current practice, and discussed findings with experienced individuals who were administering or auditing significant portfolio investments.

The conclusions of the Study Group are that fixed-term securities should be reported at amortized cost. Although the Study Group indicated that market value is conceptually superior, it recommended that until further study of related accounts (such as fixed-term liabilities matched to fixed-term investments), amortized cost should continue to be used. It also recommended that realized gains and losses on the disposal of fixed-term investments should be deferred and amortized.

For equity investments, the Study Group recommends market value as a basis for measurement. Furthermore, it argues that realized gains and losses should be deferred and amortized in the future. Similarly, unrealized gains and losses should be deferred and amortized to income using a moving average method.

The major argument given for this recommendation is that "[m]anagement should not be influenced in the timing of investment decisions because of possible accounting consequences. Reported earnings should not be managed by undertaking transactions solely for that purpose. [As a result,] [l]ess emphasis should be given to the realization and conservatism concepts" (p. 61). The Study Group therefore believes that over the long run, portfolio securities move in a reasonable trend; however, fluctuations occur in the short run that should be ignored.

The monograph is interesting from three perspectives. First, it provides an excellent review of current practice for these types of securities. Readers should find such a review interesting as some variances among industries exist. Second, the advantages and disadvantages of different valuation methods as they relate to these securities are well researched. Thus, the study provides a useful reference point for additional research on this subject. Finally, the rationale developed to justify their position is unique. Although many would disagree with the Study Group's findings, the overall framework in which it resolves the reporting problem provides a thought-provoking interplay between practical and conceptual considerations.

The monograph does not have a strong research methodology focus (nor was it intended to have such a focus), and that fact is a deficiency. However, the study might be useful in a master's theory seminar as reference material for discussion of this subject. Given its cost, it would not be suitable for purchase at the undergraduate level except as reference material for a financial accounting theory seminar.

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PHILIP BROWN, GEORGE FOSTER, and ERIC NOREEN, *Security Analyst Multi-Year Earnings Forecasts and the Capital Market*, Studies in Accounting Research No. 21 (Sarasota: American Accounting Association, 1985, pp. ix, 171, $12.00 paper).

This research monograph makes several important contributions to the accounting literature. First, it provides a good descriptive analysis of two important data bases. These are the Historical Institutional Brokers Estimate System (IBES) data base developed by Lynch, Jones, and Ryan, and the Security Market Line (Plane) data base developed by Wells Fargo Investment Advisors. Both of these data bases include, among other items, forecasts of earnings per share (EPS). The IBES system gives one- and two-year ahead consensus forecasts and the Wells Fargo data base gives one- to five-year ahead individual analyst forecasts. The authors' descriptive analyses of these data bases include a discussion of their contents as well as a wide variety of descriptive statistics that should be helpful to future researchers.

A second and primary contribution of the research study is the evaluation of forecasts of security returns. Their data provide evidence consistent with previous research indicating that one-year ahead analyst forecast errors are associated with risk-adjusted security returns. Unlike previous research, this study focuses on the association between forecast errors and security returns for horizons greater than one year. Their findings for the years 1977 through 1979 were that, on the average, five-year ahead forecast errors were more highly associated with abnormal security returns than were one-year ahead forecast errors. In addition, the data were supportive of the hypothesis that forecast errors for horizons greater than one year (especially in the two-year case) are incrementally important (relative to one-year ahead errors) in explaining risk-adjusted security returns. These results imply that the capital market uses a multi-year forecasting horizon for valuing securities.

A third contribution of this study relates to the importance of the timeliness of analysts' forecasts. It seems intuitively obvious that more timely (as opposed to less timely) forecasts should serve as superior expectations in capital market research designs. But previous research has indicated the opposite. The present study, using a more powerful design, provides evidence that supports the timeliness hypothesis.

The final contribution is a detailed literature review of management and analyst forecasts. This includes analyses of individual studies as well as an overall classified bibliography.

Overall, this research study is well organized, thorough, and methodologically sound. It should be useful to anyone interested in financial analyst forecasts.

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LESLIE G. CAMPBELL, *International Auditing: A Comparative Survey of Professional Requirements in Australia, Canada, France, West Germany, Japan, the Netherlands, the UK and the USA* (New York: St. Martin's Press, 1985, pp. xxi, 249, $30.00).

In the author's words, "[t]his book is designed to bridge the gap . . . between the literature on international financial reporting and the literature on auditing" (p. xvi). Although this ambitious objective is not entirely achieved, the book lays a sound foundation for future development.

The book consists of 16 chapters. The first two are introductory, discussing the *raison d'etre* of auditing and auditing standards. The next eight chapters, under the heading, "Comparative International Auditing," describe the environment, source, history, authority, scope, and content of auditing standards in eight countries. The countries considered are Australia, Canada, France, West Germany, Japan, the Netherlands, the U.K. and the U.S. This section occupies 104 pages, or some 43 percent of the book.

The next five chapters are grouped under the heading of "Other Issues in International Auditing," and deal with:

- the export of auditing standards
- using the work of another auditor
- international harmonization of auditing standards
- the audit of non-financial information
- the size, nature, structure, and strategies of international auditing firms.

The final chapter is devoted to a summary and review.

As a description of audit environments, the book is a great success. Its subtitle describes it as "a comparative survey," but comparisons and analysis are left largely to the reader. While the chapters dealing with separate countries are useful summaries, little attempt is made to compare the situations in the various countries. As a result, few conclusions are drawn about the relative merits of the different systems.

Although the author states that "the book should be useful to practitioners involved in the audit of multinational companies" (p. xvi), it deals only briefly with technical issues. Only two chapters are concerned with "technical" international auditing issues; these are Chapter 12, "Using the Work of Another Auditor," and Chapter 14, "The Audit of MNC's Non-Financial Information." The audit of international transactions is a notable omission.

The book also is intended to appeal to an academic audience. Although it is likely to be more successful in this market, two *caveats* need to be mentioned. First, the author presents only a superficial review of the various arguments which have been suggested as justifications for the existence of the audit function. Although no analysis is offered and no conclusions are drawn, the author proceeds to adopt the "lending of credibility" argument, basing Chapters 3 to 16 on the implicit premise that an audit is justified because it provides information which will aid in the decision-making process of financial statement users.

The second *caveat* is that the author adopts the apparently naive view that codified auditing standards are necessary "to educate the users of audit reports" (p. 26). Given that evidence suggests that users read audit reports only superficially, this reviewer doubts whether users would be likely to read professional literature any more closely.

A final concern is the explicit U.K. orientation, which will detract from its appeal to other markets. Chapter 11, "Transferring Domestic Standards Overseas," would be more accurately titled "Transferring U.K. Standards Overseas." This is unfortunate, as many of the issues considered could have been examined more fruitfully in a truly international context.

On a more positive note, the book fills a gap in the literature on international accounting and auditing. In particular, it is structurally similar to *Comparative International Accounting* edited by C. Nobes and R. Parker (reviewed October 1982, pp. 847–849). Not only are there similarities between the areas considered (e.g., international harmonization), but the countries reviewed by Campbell are the same as those reviewed by Nobes and Parker, with the addition of Japan. Together, these two books would constitute a useful reference source for courses dealing with issues in international accounting and auditing.

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GORDON B. DAVIS and MARGRETHE H.OLSON, *Management Information Systems: Conceptual Foundations, Structure, and Development*, Second Edition (New York: McGraw-Hill Book Co., 1985, pp. ix, 693, $34.95).

"The first edition was identified as a 'classic' in the field of information systems books [in a study published in] *MIS Quarterly* (December 1982, pp. 61–77)" (p. vii). The first edition dominated the "conceptual" management information systems (MIS) textbook market for nearly a decade (but was not reviewed in THE ACCOUNTING REVIEW.) The second edition preserves the valuable elements found in the first, and extends and adds to them.

At the time the first edition was published (1974), MIS was so new that the text material was not well-defined. Thus, the publication of this textbook was a step forward in defining the content and coverage required for an appropriate introduction to MIS.

This text has been extensively revised. Among the indications of this are the restructuring of its organization from three to six sections and the number of pages increased from 482 to 693. These changes were needed to communicate the expanded knowledge that must be mastered to prepare students for the information age.

Section one now includes chapters that present an overview and structure of MIS. This inclusion of the chapter on MIS structure in the first section should help students get a better grasp of the boundaries of the topics included in the study of MIS earlier in their learning experience.

The materials on the basic technology of information systems have been updated and moved forward into the second section of the book. The emphasis in this section is on fundamental technology rather than on specific details that quickly become outdated. This is written as an optional section for readers without prior exposure to computer hardware, systems software, and communications technology, or as a review for readers already familiar with these topics.

Section three has been expanded to provide better coverage of the conceptual foundations of MIS.

While the field of MIS is still embryonic, the authors have done an excellent job of meeting the challenges associated with integrating the theoretical and practical aspects of the MIS field. Further, they successfully blended materials from the behavioral sciences into the conceptual foundations section. "In many respects, the six chapters in this section are the core content of the book" (p. 161).

Section four contains an expanded coverage of MIS support systems. The traditional planning, control, and decision-making support systems are discussed. In addition, such "cutting-edge" topics as computer-based planning models and expert systems are introduced.

Section five covers a range of topics on the determination of information requirements. "The set of chapters thus provides strategies, methods, and concepts to aid users and analysts to define four sets of requirements: the overall [MIS] plan, application information requirements, database content, and user interface requirements" (p. 442). Despite trends to provide direct computer-based support to users, a need continues for significant cooperative efforts between users and MIS professionals. After reading this section, students will be aware that determination of information requirements is a vital part of this cooperative activity.

Section six includes materials on the development, implementation, and management of information system resources that have been rewritten and reorganized. After stating that "[i]nformation is a resource that should be managed" (p. 561), the authors discuss the related topics including the "development and implementation of information applications, quality assurance, and the organization and management of the information resources function" (p. 561). Other "cutting-edge" topics such as prototyping and artificial intelligence also are introduced.

Overall, the book is suitable as a stand-alone text for either an undergraduate MIS course or an MBA survey course. But for a graduate/professional level MIS course, the instructor should consider using cases and/or readings to augment the questions/excercises/minicases provided at the end of each chapter in this otherwise excellent MIS textbook.

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DEMPSEY DUPREE and MATTHEW MARDER, *Principles of Accounting* (Reading, MA: Addison-Wesley Publishing Co., 1984, pp. xxxvi, 1,322, $28.95).

This new textbook is a detailed presentation of introductory accounting most suitable for the community-college student and instructor.

In designing the textbook, the authors have a number of rather ambitious objectives: "Coverage must provide an understandable overview of accounting for non-accounting majors, yet contain sufficient scope and detail for accounting majors to acquire a solid foundation for intermediate level courses in accounting" (p. vii). The book must "present in a clear manner, in a logical progression, and in a fresh way the many facets of the intriguing field of accounting" (p. vii).

The authors, editors, art designers, printers, and the corps of reviewers seem to have achieved these objectives.

The textbook is divided into nine parts with 26 chapters, plus four appendices: International Dimensions of Accounting, Solutions to Self-Quizzes, Corporation Financial Statements, and Alternate Problems.

The chapters are organized into nine parts, each with its own statement of learning objectives, glossary of terms, self-quiz, and discussion questions. The exercises and problems for all the sections are found at the end of the chapter. A set of alternate problems is found in Appendix D.

The learning process is facilitated by stressing accounting concepts in bold- and light-face print. The type size and the graphics also enhance readability.

In their revisions, the authors might consider:

- Pruning the manuscript to a more manageable size.
- Deleting the 15 accountants' profiles.
- Expanding Chapter 11 to cover microcomputers and their potential use in the firm.
- Dropping topics such as international accounting, changing prices, consolidating financial data, and cost and revenue behavior.
- Coordinating the sequence of the exercises and the problems with the sequence of the presentation of the material in the body of the chapters.
- Transferring the alternate problems from the appendix to the appropriate chapters.

The textbook is supported by a system of teaching aids. For the student these include working papers, a study guide, manual practice sets, computer practice sets, a checklist of key figures, and a software tutor. For the instructor these include a solutions manual, transparencies for solutions and illustrations, an instructor's resource guide, a test bank, achievement tests, and a solutions manual for practice sets.

This textbook is best suited for courses taught in junior colleges and for nonaccounting majors.

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SAMUEL EILON, *The Art of Reckoning: Analysis of Performance Criteria* (Orlando: Academic Press, Inc., 1984, pp. xv, 507, $39.50).

Beyond a doubt, the managerial accountant needs to recharge his or her batteries from time to time by exploring the current literature in related disciplines. Thus, a new book on performance analysis by a well-known authority on management science has to be examined seriously. Unfortunately, the analytical technique that is the central feature of this book is interesting more for its technical ingenuity than for its managerial usefulness, but some instructors will find these techniques worth exploring.

The first part of this book establishes a structure of key reporting variables, including productivity ratios, derived by a ratio decomposition process. Simple indifference maps also are used in this analysis. Although this discussion provides some food for thought, the main subject matter of the book emerges in Chapter 4, consisting of a set of calculations Professor Eilon refers to as the "*incremental calculus*, . . . where the major concern is with the magnitude of *relative changes* (or percentage changes) of key variables in the system" (p. x).

Basically, this consists of establishing mathematical relationships between the change in a specified ratio and the changes in the component ratios into which that ratio can be decomposed. For example, the ratio of profit to investment can be decomposed into three multiplicative ratios:

$$\frac{\text{Profit}}{\text{Investment}} = \frac{\text{Profit}}{\text{Output}} \times \frac{\text{Output}}{\text{Capacity}} \times \frac{\text{Capacity}}{\text{Investment}}$$

Professor Eilon then equates the period-to-period difference in the profit/investment ratio to a set of expressions based on the changes in the three component ratios.

The final three-fourths of the book consists of elaborations on this basic idea and its application in a number of specialized contexts—e.g., cost-volume-profit analysis, product pricing, and return-on-investment evaluation. The analysis is expressed mathematically in a form easily understandable by those conversant with college algebra and simple calculus, but it also contains a liberal sprinkling of iso-value diagrams, many of them highly complex and difficult for the mathematically untrained.

Each chapter has a number of short mathematical exercises, and ten chapters contain lists of references for further reading. (Interestingly, 31 of the 52 listed references are to other publications by the author.)

Although the author demonstrates considerable technical virtuosity, the resulting analysis is remarkably remote from the solution of real managerial problems. For example, Chapter 8, "Price and Volume," starts with an elementary discussion of supply and demand curves, develops the mathematics of elasticity of demand, and continues through the application of mathematics to postulated demand and supply curves. The relevance of the analysis to managerial pricing problems is largely unexplored.

The exercises accompanying each chapter suffer from the same lack of a managerial context. Most of them read like problems in mathematics textbooks, in which solution of the problem is its own reward. A typical exercise reads as follows: "For the example in Fig. 13-12, calculate the value of Z^* for $p^* = 5\%$ and 10% respectively, when w^* ranges from 0 to 8%" (p. 493).

This is not to say that this book is entirely without interest. Some instructors, for example, may wish to assign the discussion of ratio decomposition and productivity measurement in Chapters 1 and 2 to supplement other materials on those topics. Others may find it useful to assign Chapter 4, "The Rules of Incremental Calculus," after they have covered conventional variance analysis, to which it bears a family resemblance. (The author's "multiplication rule" for incremental calculus decomposes a change ratio into two "pure" components and one "mixed" component, just as a direct-labor cost variance can be decomposed into price, usage, and joint price/usage components.) If time permits, the instructor may even choose to explore one or more of the applications of the calculus in later chapters, but coverage of them all clearly would be carrying a good thing too far.

In short, this book is an intriguing exercise in technical virtuosity, but the reader will have to wait for a later volume for convincing evidence that the techniques have solid managerial applicability.

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How Your Government Can Apply GAAP: An Ernst & Whinney Guide to Better Financial Reporting (Cleveland: Ernst & Whinney, 1982, pp. xxii, 335, $40.00).

As its title indicates, this book is designed to help finance directors and others improve their government's financial reporting. While the emphasis is on governmental reporting, most of the financial reporting concepts are equally applicable to nonprofit organizations.

In a governmental context, GAAP refers not to the body of SAFSs and APB Opinions that comprise GAAP for the private sector, but rather to the body of concepts and principles that have been enunciated over the years by groups concerned with public sector reporting, such as the National Council on Governmental Accounting.

The E&W Guide is organized into 14 modules or chapters and four appendices. Each module deals with one major aspect of governmental reporting, starting with an overview of GAAP and the Comprehensive Annual Financial Report (CAFR) for governments. The second module provides a guide to evaluation of a government's current financial report, while the next three modules deal with project planning and control, determination of the reporting entity (not an easy task given the wide scope of governmental funds and activities), and systems considerations. The remaining nine modules deal with specific reporting problem areas, from revenue recognition to financial statement notes.

The book emphasizes the practical aspects of governmental reporting, not theoretical discussions. One of its strong points is that it is never dogmatic but always points out alternatives and the circumstances in which each is appropriate. In discussing fixed asset reporting, for example, those funds and activities in which depreciation accounting would increase the usefulness of reported results are clearly distinguished from those in which depreciation accounting would not be useful.

Indeed, the book is quite effective in relating the concepts of governmental accounting to the decisions being made by the users of the statements and in showing how governments can benefit directly from improved financial reporting. Planning and control considerations are integrated into the material. Two of the appendices deal specifically with computer systems considerations and guidelines for evaluating computer software.

To make the book as helpful as possible to users, extensive checklists are provided in the applications modules to assist in the specific application of improved financial reporting. About one-half of the book's text pages are devoted to checklists. Applicability is further enhanced by inclusion of a diagram of time period relationships that shows when each module should be started and completed relative to the other modules in preparing a comprehensive financial report (p. 4).

The volume is written clearly and succinctly, and should be very useful to financial officers and directors not only in governments but also in nonprofit organizations. It also provides a useful overview of GAAP in the public sector for those of us who are not directly involved in the preparation of governmental financial reports but who are interested as students, users, or critical observers.

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STEPHEN A. LIND, STEPHEN SCHWARTZ, DANIEL J. LATHROPE and JOSHUA D. ROSENBERG, *Cases and Materials on Fundamentals of Partnership Taxation* (Mineola, NY: The Foundation Press, Inc., 1985, pp. lv, 415, $21.50).

This volume has the distinction of being the first *textbook* exclusively devoted to partnership taxation. Its immediate success is well deserved. Two leading competitors have taken a large two- or three-volume loose-leaf service, thrown out a number of esoteric chapters, and published the remaining chapters in a "Student Edition" paperback without editing of any kind! In contrast, the present text is well integrated, presents complex material in a pedagogically sound fashion, has many good examples and carefully designed problems, and does the job in 415 pages! It is a real contribution and, although a textbook, it is recommended to anyone who wishes to learn more about Subchapter K than is found in a general textbook.

In the words of the authors: "For the uninitiated, the fundamentals approach involves selectivity of subject matter, an emphasis on basic concepts, avoidance of esoteric detail and realistic depth of coverage" (p. xxi). The book clearly keeps these promises, but it assumes some minimum tax knowledge on the part of the reader, notably in individual and corporate taxation.

The organization of the book is the standard one, e.g., Definition of a Partnership, Formation, Operations, Dispositions of Partnership Interest, Distribution, Liquidations, Death of a Partner, and Tax Shelters. In addition, a good survey of "S" corporations is provided, as well as estate planning considerations.

In the beginning of the book, the reader will find tables of Code Sections, Regulations, Rulings, Cases, and Authorities. To make the book more complete, an example of a filled-out Form 1065, U.S. Partnership Return of Income, should be provided. The Teacher's Manual is 209 pages long and provides unusually in-depth and up-to-date solutions to all problems as well as suggestions for additional points to discuss. Most, if not all, graduate tax programs offer courses in corporate taxation and its less glamorous cousin, partnership taxation. Less glamorous it must be, since the former is invariably a required course, the latter an elective.

The book is tailor-made for a one-term course in a graduate tax program, be it in a business or law school. Although the book is written by law professors and published by a well-known law school textbook publisher, it is eminently suited for business schools. The text is well-written and a pleasure to read, the problems are excellent, up-to-date, to the point, and relevant. Time should permit the discussion of *all* the problems, particularly in a one-semester course. The numerous, and carefully selected, excerpts from court cases, revenue rulings, committee reports, and the like are well integrated into the text for a well balanced treatment of the material. The volume is completely up-to-date for the Tax Reform Act of 1984 and is a valuable addition to the growing number of college textbooks in taxation.

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GLENN M. PFEIFFER and ROBERT M. BOWEN, *Financial Accounting: A Casebook* (Englewood Cliffs: Prentice-Hall, Inc., 1985, pp. viii, 214, $14.95 paper).

In the absence of widely embraced notions of what a casebook should be like, it is unavoidable that a critical review will depend heavily on the tastes and preferences of the reviewer. This review will be no exception.

I am using this book for the second time during Fall 1985 and am working with a co-author on a similar type of book. Thus, it is evident that, while this book is the most suitable book available for my first-year MBA course, I am not fully satisfied that it does the job as well as it can be done.

The book is organized topically to parallel a majority of first-level texts in financial accounting: initial exposure to the balance sheet and income statement, elaborations on accrual accounting, systematic treatment of asset and equity account groups as they appear on the balance sheet, coverage of the funds flow statement, basic financial ratio analysis, and a look at accounting for changing prices. Since my preference is to introduce funds flow statements almost at the outset, and to use an early consideration of financial analysis as motivation for further study of valuation and income measurement issues, this is not the ideal layout. I have adapted the book by rearranging the sequence of cases, but this is difficult because of the level of sophistication required to work the later cases.

The early cases include an exercise on preparing a personal balance sheet, two record-keeping cases, the origins of which are unclear, and another case involving a rather detailed description of a manufacturing process. Of the six cases in the first section, only the last two seem appropriate to an MBA-level course. Even these could be less computational.

Matters improve in the second section (on income recognition) in the sense both of suitability to an MBA orientation, and of the mix of qualitative and quantitative requirements. My major reservations with these cases relate to the style of questions posed: several are sterile. For example, in a case on revenue recognition policy the student is asked if "the company's performance is accurately portrayed" (p. 21). The difficulty is in determining the frame of reference that should be applied to measure accuracy. Similarly, normative questions such as when revenue should be recognized, or evaluative questions such as which method best reflects financial condition, would seem to place unreasonable demands on students.

Requirements of the style just criticized also appear in cases in later sections, although often with somewhat more direction (e.g., "What alternative would you recommend?" [p. 74], or, "Discuss the pros and cons of the Financial Accounting Board's Decision" [p. 81]). Other ambitious questions ask students to conjecture on behavior, e.g., "How might this fact affect accounting standard setters?" (p. 87).

The authors hit upon a more useful type of requirement when they question students on the consequences of changing a method of accounting. These questions may relate to the effects on the statements, or to the underlying economic conditions such as the impact of an accounting policy change on loan agreements. The move to the equity side of the balance sheet is accompanied by another useful type of requirement: those that relate more to finance than to accounting. Representative of this type are questions on motives for buying or issuing zero coupon bonds. Although only tangentially related to accounting, such questions force students to broaden their perspective.

In the second and third sections, the treatment of marketable securities is limited to a part of one case. This could be improved with the inclusion of a further case, possibly with some mention of the variation in practice for certain industries. Receivables and inventories are given adequate attention, but the coverage of long-lived assets is quite modest relative to the many topics that fall under that heading. Notwithstanding the limited coverage, I liked the capitalization issues dealt with.

The five cases in the fourth section are devoted almost entirely to bonds. While this may seem to be an overemphasis, this number is justified by the range of topics addressed (i.e., pricing, ratings, interest recognition, early retirement). Also embedded in these cases are important concepts of present value, hedging, contract incentives, and wealth transfers. This may be the best section in the book.

Leases, pensions, deferred taxes, and tax losses comprise the fifth section. These are topics that lend themselves to a case study approach, and the authors take advantage of this to provide some of their better "as if" and "what are the consequences" requirements. While a second-level topics or intermediate course would warrant more cases (e.g., a case on lessor accounting), the coverage is quite satisfactory for a first-level course.

Although the set of cases in the sixth section on stockholder's equity and intercorporate investments is stretched rather thin, there are cases on most of the issues that are likely to be covered in an introductory MBA course. Requirements in a couple of instances tend to be a bit repetitive, but generally the authors extract a good deal out of the reports they employ. Moreover, the cases are sufficiently modest in their demands to be suitable to a first-level course (albeit a fairly ambitious one).

The seventh section provides cases on both funds flow and statement analysis. As mentioned earlier, by coming so late in the sequence, the funds flow cases assume a prior exposure to fairly sophisticated issues. Neither of the two statement analysis cases were very appealing: the first is computational in character, and the second is open-ended with lots of data.

Finally, section eight provides what is perhaps the author's best mix of qualitative and quantitative requirements. Assuming that students can read the fine print, they will find the excerpts from two of the reports used to be quite enlightening, both on the complexity of procedures for adjusting for changing prices and on the ways in which the companies position themselves politically for the effects of inflation.

To sum up, this is the best book of its type around. Those contemplating adopting it should not let my quibbles deter them from a careful examination of its contents.

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JOSEPH R. RAZEK and GORDON A. HOSCH, *Introduction to Governmental and Not-for-Profit Accounting* (Englewood Cliffs: Prentice-Hall, Inc., 1985, pp. viii, 472, $31.95).

This book is written to be used as a text in accounting courses, such as advanced accounting or accounting theory, where students wish to learn fund accounting in less than a full-semester course. It should serve well in public administration and other programs for nonaccounting majors who want a basic understanding of fund accounting.

The text claims to require no background in accounting. Because of an independent chapter on the fundamentals of bookkeeping, students without a background in accounting should be able to use most of this book effectively, but they probably will find some portions very difficult. For example, even though the authors devote 30 pages to bookkeeping and the accounting cycle, the student with no previous exposure to accounting certainly will be challenged in solving a lengthy problem adapted from a CPA examination fund accounting problem.

The text breaks into five parts: (1) a two-chapter introduction to accounting and the fundamentals of bookkeeping, (2) a chapter providing an overview of the use of funds in governmental accounting, (3) six chapters covering the governmental fund accounting cycle, (4) a two-chapter introduction to the budgetary process and the process of control, and (5) three chapters covering other not-for-profit organizations in some depth.

Many of the authors' examples are adapted from financial statements for cities and other not-for-profit organizations. Although greatly condensed, they provide a level of authenticity not achieved in most accounting texts. The overview of fund accounting in Chapter 3 does an exceptional job of introducing each type of fund or account group.

Except in the section on other not-for-profit organizations, the presentations move from simple to more complex examples. For each type of fund, the coverage includes definition and use, summary of activities, operating control, general accounting procedures, closing entries, and financial statements. Unfortunately, the excellent examples of accounting for funds do not generate their own financial statements; instead, the examples are referenced to the unrelated financial statements in the overview in Chapter 3. One of the major strengths of the book also becomes one of its major weaknesses. A clear distinction is maintained between entries involving budgetary accounts and entries reflecting transactions.

Although this book was written before the Governmental Accounting Standards Board was formed, it is current with excellent use of NCGA (National Council on Government Accounting) statements and the conceptual framework. The balance between conceptual and practical presentations is excellent.

The last three chapters covering other not-for-profit organizations (colleges and universities, hospitals, and other not-for-profit organizations) are written at a different level. The illustrations are more complex than those in the government accounting cycle, and launch immediately into extensive financial statements that extend through several pages. After the very understandable development of the materials for the various funds in governmental accounting in the first eight chapters, the student with no accounting background (as well as many with some accounting background) will experience considerable difficulty in these three chapters.

Each chapter is accompanied by a good bibliography of current readings, as well as questions, exercises, and problems. The problem material ranges from essay questions and fill-in-the-blank exercises to problems adapted from the CPA examination. Those interested in a more conceptual and less procedural coverage (such as public administration classes) may use the questions and exercises, while accounting classes may also use the problems requiring journal entries and financial statements. The problem material is uneven, ranging from no problems in one chapter to 15 in another.

A significant improvement in this text would be the addition of short cases that could provide vehicles for analysis and class discussion. While the questions and exercises are very good, they tend to be too limited to serve as a basis for good class discussion. Nearly all the problems emphasize procedural approaches, particularly journal entries.

I used this text to introduce governmental and not-for-profit accounting as part of a four-semester-hour advanced accounting course. The major fund accounting texts were too extensive and the chapters in the advanced accounting text too limited. For my purposes, the text was excellent. Although students complained about purchasing three textbooks, their comments in the course evaluations were very favorable, including: "very understandable," "easy to follow examples," "the governmental accounting text prepared me well for the governmental accounting problem on the CPA exam," and "boring problems—but I understood the material after completing the assignments."

This text is well written, with short sentences and plain language. It covers a large amount of material in a small space. It presents an excellent blend of conceptual and practical material. It is doubtful that the text would serve as the primary text for an entire accounting course, but it is excellent for an introduction to governmental and not-for-profit accounting comprising a part of a broader accounting course. This text also should serve well in a public administration or professional development program.

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J. M. SAMUELS and A. G. PIPER, *International Accounting: A Survey* (New York: St. Martin's Press, 1985, pp. viii, 197, $27.50).

This book was commissioned by the Economic and Social Research Council of the United Nations as part of its accounting initiative. It is a compendium of the major articles, papers, reports, and books written in the field of international accounting. It has some positive features. It contains a detailed analysis of the reasons for the spread of international accounting ideas between countries. Of particular value from a historical perspective is the analysis of the major influences on the spread of international accounting dating back to the beginnings of double-entry bookkeeping. Included in this analysis are the contributions of the United Kingdom, the United States, and Continental European countries. This material is too often overlooked in international accounting textbooks. Another positive feature is a review of the literature that either describes the accounting methods of a particular country, or compares the methods of one country or group of countries with those of another country or group. As the authors point out, the primary problem with research in these areas is the limited focus on the causes of differences and the characteristics of a country which may lead to its accounting methods.

The majority of this book does not provide any significant new contribution to the existing literature in international accounting. The authors fall victim to their own scope limitations. The areas they chose for more detailed consideration are those which they deemed of particular importance or where the existing literature is confusing or inadequate. In the latter case, the discussion is very interesting but all too brief. The main area of "particular importance" is the description of the conceptual and practical problems of trying to achieve harmonization and/or standardization on an international level. This section comprises over 40 percent of the book. In the field of international accounting many articles and books debate the merits of harmonization, standardization, and uniformity. Similarly, many writings deal with the establishment and enforcement of international accounting standards. By making this area their primary focus, the authors have produced a book that doesn't add measurably to the knowledge of an individual who is reasonably sophisticated in international accounting.

The authors conclude that while interest in the international aspects of accounting clearly is growing, significant research on the subject has not increased commensurately. They feel too much of the writing states personal or professional opinions without developing an appropriate frame of reference for testing ideas such as the behavioral, organizational, or economic point of view. This is a valid observation. The question that must be asked is: Of what value is a book that devotes most of its attention to areas already well explored in the existing literature and that, according to the authors, has not been researched from the proper perspective? The authors should have devoted more than a few pages to exploring these different frames of reference.

The authors do accomplish their primary objective of presenting a broad survey of the writings in international accounting. This book would be useful to someone conducting research in international accounting for the first time. The literature review is quite extensive and is more valuable than the currently available bibliographies on international accounting. This book would not be good as the primary text or supplementary readings for a course in international accounting. The current textbooks and readings available are more thorough and devote more time to the important areas of managerial control and financial reporting.

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JAN R. WILLIAMS, KEITH G. STANGA, and WILLIAM W. HOLDER, *Intermediate Accounting* (San Diego: Harcourt Brace Jovanovich, Publishers, 1984, pp. xv, 1,328, $34.95).

Innovations in accounting pedagogy occur rather infrequently and when they do, they are often slow to be adopted or integrated by the academic community. An example is textbooks, in particular, those in intermediate accounting, where the "new" book for the year usually is a clone of an existing bestseller—an improved or enhanced version of Kieso and Weygandt or Welsch, et al. Thus, many will appreciate our enthusiasm for *Intermediate Accounting* by Williams, Stanga, and Holder (WSH).

WSH have produced an innovative and effective text to guide accounting students through the maze of topics of intermediate accounting. The text is organized in a conventional manner:

Section 1—Theoretical Foundations for Financial Reporting (Chapters 1–4)
Section 2—Tools of Accounting (Chapters 5–6)
Section 3—Asset Accounting (Chapters 7–13)
Section 4—Liability and Stockholders' Equity Accounting (Chapters 14–17)
Section 5—Additional Financial Reporting Issues (Chapters 18–24)
Section 6—Financial Reporting by Publicly Held Companies (Chapters 25–27)

But in comparison with the "conventional" intermediate accounting textbooks, the similarities of organization and topical coverage are overshadowed by the introduction of effective pedagogical tools designed to aid the student and the instructor in mastering the complex/comprehensive material of the core accounting course.

The pedagogical aids include:

- Chapter Organization: Each chapter begins with a list of key objectives and ends with a summary of key points.
- Chapter Content: Sprinkled throughout the text are short excerpts from business and accounting literature. These selections are well-chosen and serve to highlight or expand the student's comprehension of the issues and controversies related to the chapter content. Also, most chapters include examples from published financial statements to illustrate disclosure and reporting concepts. The financial report excerpts are integrated into the narrative of the chapter.
- Chapter Illustrations: Charts, diagrams, and

flowcharts are clear, effective, and adequately explained.

- Theory versus Practice: The book has a well-balanced presentation of accounting concepts and accounting procedures. The model of financial accounting theory is introduced in Chapter 2. Although the model presented is a bit of a hodge-podge of abstractions from FASB Concepts Statements 1-3 and APB Statement 4, the model is consistently and effectively integrated and reinforced in each chapter by the insertion of a bold marginal prompt as the concepts (e.g., consistency, conservatism, and materiality) relate to the specific topic under consideration. The careful integration of the broad accounting principles and modifying conventions into the discussion of detailed accounting principles provides significant opportunities for student insight and discussion of the role and relevance of judgment in the accounting process.
- Supplements: The text has the standard fare of study aids—end-of-chapter material that includes a reasonable selection of cases, exercises, and problems; a student study guide; two practice sets; working papers; a solutions manual (with transparencies); a test bank (including a computerized version); and a checklist of key figures. The quality of these supplements is generally very good, well-written, and relatively error-free.

We evaluated the overall quality of the WSH text on the basis of its ability to aid in the development of: (1) fundamental principles and theories of accounting; (2) specific accounting skills, competencies, and procedures; (3) choosing the appropriate GAAP for specific accounting and reporting situations; and (4) professional attitudes. In a comparison with other texts with which we are familiar, we consider the text to be above average to excellent in all of the above areas. Further, with the pedagogical enhancements to efficiently provoke classroom discussion, this text is FUN to use.

The textbook, for the most part, is very well-written. Students generally are able to understand the various concepts and procedures presented without a great deal of help from the instructor. This degree of understandability frees the instructor from using valuable class time to explain things the authors should have explained. The difficult chapters dealing with leases, pensions, statements of changes in financial position, and earnings per share are presented in a clear and straightforward manner.

To provide an indication of student attitudes toward the text, students were asked to evaluate several features. The statistics presented are based on a survey of students ($n=55$) that used WSH during the Fall 1984 semester.

The model of financial accounting theory presented in Chapter 2 was favored by 96 percent of the students. Not surprisingly, 100 percent favored using the marginal prompt to integrate and reinforce the theoretical model throughout the text. The most frequently cited reason was that this approach was helpful in achieving an understanding of GAAP and how it is applied.

Over 96 percent of the students viewed the supplemental readings favorably. These readings actually may accomplish more than their intended purpose of increasing students' awareness of issues and controversies surrounding financial accounting. Some evidence indicates that they make the text more interesting and break the monotony associated with reading an accounting textbook.

Students also responded favorably to the real-world financial disclosures (90 percent) included in the text and the flowcharts of SFASs (88 percent). In both cases, students felt that these materials helped increase their understanding of the text material and the application of GAAP in various reporting and disclosure situations. The flowcharts also were seen as an excellent way to summarize the complex rules discussed in several pages of text.

Students found the summary of key points helpful (91 percent) in studying and reviewing for tests. Only 37 percent viewed the lists of objectives at the beginning of each chapter as important. In the latter case, students placed more reliance on what the instructor emphasized in class.

This first edition is not without some problems. The statement of changes in financial position presented in Chapter 4 omitted dividends as a use of funds (p. 119). The end-of-chapter material does not contain the number of problems that some instructors consider necessary. Generally, those instructors who use *only* a problem-solving approach probably will run out of problems rather quickly. The problems also tend to be either too easy (replications of text illustrations) or extremely challenging (CPA/CMA problems). The "cases" are not cases in the traditional sense; many are essay questions from the professional examinations and may be of some value in assessing or improving writing skills.

In summary, this new book deserves careful review as the primary text in intermediate accounting. The innovative pedagogical attributes generally are well-received by students. The excellent balance between the conceptual and the procedural aspects should be appealing to instructors who are weary of detailed rules and mechanical approaches.

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CAPSULE COMMENTARIES

Harvey S. Hendrickson, Editor

FLOYD A. BEAMS, *Advanced Accounting*, Third Edition (Englewood Cliffs: Prentice-Hall, Inc., 1985, pp. xvi, 958, $34.95).

"If it's not broken, don't fix it," best summarizes the author's revision philosophy for this third edition. Very similar to the second edition (reviewed January 1983, p. 175) Professor Beams has again produced an excellent teaching-oriented text packed with up-to-date, real-world material. The publisher has complemented his efforts by adopting a new eye-opening art and type style.

The text devotes its first 12 chapters to business combinations—carefully arranged in such a way as to allow selected detailed topics to be omitted without detriment to a student's logical learning progression. The last half of the book includes chapters on branch accounting, international accounting, segment reporting, partnerships (two chapters), financially troubled enterprises, governmental accounting (two chapters), and nonprofit entities. Although the text has not undergone substantial revision from the previous edition, the author carefully searched his product for areas that could be improved. General changes include selective revision of problem material, consistent use of a simplifying unamortized excess account in consolidation work papers, and introduction of a "conversion-to-equity" approach to reduce the number of procedural alternatives confronted by a student. More specific changes also were made; for example, in Chapter 4 the presentation of alternative working paper formats has been moved to a separate location, in Chapter 5 the presentation and explanation of intercompany inventory transactions has been revised (and should be more understandable to the student), and in Chapter 6 the Uniform Partnership Act has been added in an appendix. In addition to these "discretionary" revisions, the author obviously has been very careful to be technically up-to-date, to reflect not only major events such as SFAS No. 52 (as amended) and the creation of the GASB, but also to include changes necessitated by less publicized SEC bulletins. Finally, tremendous effort must have been exercised to obtain the numerous revised annual report and business journal excerpts.

Accompanying the text are the *Solutions Manual*, an *Instructors' Resource Manual* (that includes chapter outlines, examination questions, and lecture aids), and a set of partially completed working papers. The supplements to the previous edition were virtually error-free—hopefully this will again be the case.

The author has done an excellent job of preparing this third edition. It well deserves the consideration of those seeking an advanced accounting text.

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AHMED BELKAOUI, *Théorie Comptable* (*Accounting Theory*), Second Edition (Sillery, Québec: Les Presses de l'Université du Québec, 1984, pp. 416, Can. $35.00).

This second edition represents a significant improvement over the first (reviewed July 1982, pp. 641-642). The principal changes can be summarized as follows:

1) the number of chapters has been increased from 13 to 15,
2) certain chapters have been expanded,
3) the number of pages has increased from 337 to 416,
4) references to the topics discussed are presented at the end of each chapter, and
5) this edition is in hardcover.

As before, the book is organized into three parts:

- Accounting Theory,
- Asset Valuation and Income Determination, and
- Controversial Topics.

The first part of the book, "Accounting Theory," benefits most from the expansion mentioned above. Eight out of the 15 chapters are devoted to this section, discussion of several topics has been expanded, and new subjects have been introduced.

Chapter 3, "The Regulatory Approach," presents the different standard-setting bodies as well as the reasons for and the process of standard-setting in the United States, the United Kingdom, and Canada.

Chapter 4, "The Events Approach and the Behavioral Approach," and Chapter 5, "The Predictive Approaches and the Positive Approach," present an in-depth discussion of the topics discussed in Chapter 3 of the first edition with the addition of new material on the behavioral and positive approaches.

Chapter 6, "The Conceptual Framework," is a more fitting and complete version of the earlier Chapter 4, "The Nature of the Objectives of Financial Accounting." The presentation of the conceptual framework in the United States, the United Kingdom, and Canada represents a major addition to and a significant improvement in the material discussed.

It should be pointed out that there is no mention of agency theory in this part of the book, "Accounting Theory."

The second part of the volume, "Asset Valuation and Income Determination," as well as the third part, "Controversial Topics," underwent very little or no revision compared with the first part.

In summary, the author has without doubt placed at the disposition of professors and students a much improved edition of this book, whose primary strong points are the presentation in French, in a clear, simple, and concise form, of the foundations of accounting theory.

Théorie Comptable should be considered seriously for accounting theory and advanced courses. It is recommended as well to professional accountants willing to develop their conceptual skills, thereby sharpening their professional judgment.

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JEREMY BERNSTEIN, *Three Degrees Above Zero: Bell Labs in the Information Age* (New York: Charles Scribner's Sons, 1984, pp. xiii, 241, $17.95).

This thought-provoking book, written by a science writer for *The New Yorker*, is on the Bell Laboratories, the research and development division of AT&T. Retrospectively, it commemorates the Bell Labs' 60 years as one of the world's most effective, prestigious research centers, and prospectively, it raises questions as to the changes (e.g., a deemphasis on pure research) that may come as a result of the 1984 divestiture.

The title refers to the average temperature of the universe, about three degrees above absolute zero, which was discovered by two Bell radio astronomers who later were awarded the Nobel Prize in Physics.

Organized into four parts and 15 chapters or essays, many based on personal interviews, the book provides insight and stimulating reading on the Bell Labs—both past and present—in the areas of organization, operation, important research projects, and key personnel. This book should provide interesting, relevant reading to accountants wishing to learn more about science and successful organizational structures and styles.

H.S.H.

D. R. CARMICHAEL and MARTIN BENIS, *Wiley-Ronald Auditing Service* (New York: John Wiley & Sons, 1984, pp. viii, 585, $85.00 looseleaf).

The interpretation of the technical "prose" of a specific Statement on Auditing Standards (SAS) has never been a simple, or easy, task for auditors, accountants, or students of accounting. The stated purpose of this service is to "help independent auditors in the application of and compliance with generally accepted auditing standards" (p. v), to "help students by providing understandable explanations of fundamental requirements and objectives of every SAS" (p. vi), and to assist "auditing educators to prepare lectures" (p. vi). The authors have attempted to accomplish these objectives by dividing each section of the AICPA *Codification of Auditing Standards* into six logical segments—Effective Date and Applicability, Definitions, Objectives, Fundamental Requirements, Techniques for Application, and Illustrations—and by restating the technical language of the original pronouncement in an "easy-to-read and understandable advice" (p. v) format.

The restated "Fundamental Requirements" are easy to read and understand and, when combined with the subsequent "Techniques for Application," should help users to comply with the requirements of the SAS. The inclusion of example audit programs and checklists to help assure compliance with the pronouncements (and documentation) should be helpful to members of the smaller CPA firms who do not have much depth of experience or ready access to the audit manuals and review instructions that are written by and available in some of the larger CPA firms.

The explanations are helpful but often the approach is different from that used in current auditing texts. The nearly total lack of references to the Auditing Interpretations issued by the staff of the AICPA's Auditing Standards Division in the authors' explanations, comments, and notes, however, is disturbing. Although the Auditing Interpretations are not as authoritative as the SASs, the auditor would have to justify departure from them should the quality of his work be questioned. In the next revision of this work, consideration should be given to including appropriate references to the explanations of the Auditing Interpretations.

The authors state they hope that "many auditors will never again have to read an SAS" (p. vi). The likelihood of this being realized would be increased if the Service had a listing of the effective SASs and/or if the index listed where particular SASs are presented. This reduces the usefulness of the Service to an auditor, accountant, or student wishing to learn or review requirements of an SAS.

In summary, this service appears to be a useful reference work for the practicing CPA because of its easy-to-understand writing style and consistent order of presentation. It also should be considered as a potential supplemental reference in an auditing principles or CPA examination review course, or in an auditing seminar.

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PETER T. CHINGOS, NEIL R. CRONQUIST, PETER I. ELINSKY, CHARLES W. GILL, and MICHAEL J. WALTERS, *Financial Considerations of Executive Compensation and Retirement Plans: Accounting, Actuary, Tax and Plan Design* (New York: John Wiley & Sons, 1984, pp. vii, 236, $39.95).

The authors, all of Peat Marwick, have produced a clear and concise desk reference on the major types of employee compensation and retirement plans. The coverage of tax and financial accounting implications of the plans is thorough; where relevant, the actuarial literature is discussed clearly.

Particularly useful are the chapters on stock-based and formula-based awards. All "pure" forms of the commonly-used plans are considered, among them qualified and non-qualified stock options, stock appreciation rights, phantom stock units, and performance shares. In each case the tax consequences to both the firm and employee are covered, and the financial accounting effects are clearly illustrated. This includes not only the determination of compensation expense, but the differing effects of the plans on deferred taxes and earnings per share, topics often not adequately covered in intermediate texts.

The chapter on pensions skillfully handles the complex interactions between actuarial methods and assumptions and the many pronouncements of the APB and FASB. The authors cover not only APB Opinion 8, which was certain to be replaced at the time the book was written, but also the preliminary releases of the FASB's pension project. Unfortunately, parts of the chapter still will become obsolete when the FASB finally issues new rules for pension accounting. Relevant actuarial pension issues are clearly explained. After reading the chapter, the non-actuary will be able to make a basic calculation of the present value of plan benefits, analyze the sensitivity of the calculation to changes in actuarial assumptions, and understand the enrolled actuary's certificate which must accompany filings under ERISA. An obvious topic that does not receive sufficient coverage is the termination of pension plans, a phenomenon which has become increasingly frequent in recent years.

Taxation dominates the discussion of distributions from qualified retirement plans. Again, the writing style contributes to the understandability of difficult topics such as rollovers, ten-year averaging, lump-sum and multiple distributions, loans to plan participants, and the distribution of employer securities.

This book will be of most value to practicing financial accountants, tax accountants, and compensation consultants. It also could serve as useful library reserve material for intermediate accounting and tax courses.

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GERALDINE F. DOMINIAK and JOSEPH G. LOUDERBACK III, *Managerial Accounting*, Fourth Edition (Boston: Kent Publishing Co., 1985, pp. xxiv, 794, $35.00).

Most managerial accounting texts can be placed in one of two categories. Some initially focus on the anatomy and workings of the accounting system while others have more of an information orientation. *Managerial Accounting*, with its emphasis on management functions, decision models, organization and human behavior, and management information needs, clearly belongs in the latter category.

Previous reviewers (THE ACCOUNTING REVIEW January 1986, pp. 217–219; October 1979, pp. 853–854; and January 1983, pp. 199–200) have agreed that this is an excellent text. They were unanimous in their view of the text's strengths: clarity, organization, the step by step manner in which progressively more difficult concepts are introduced, and the liberal use of effective illustrative problems. The fourth edition carries forward these virtues.

This text has two other important strengths. First, the authors' integration and reinforcement of concepts throughout the text is an effective pedagogical tool. A major concept or principle, once introduced, is not abandoned. Instead it is reapplied and reinforced in appropriate new settings. For example, a problem relating to the measurement and evaluation of divisional performance might require a student to determine an appropriate pricing strategy based on the results of a cost-volume-profit analysis, a technique first introduced much earlier in the book.

A second strength not previously noted is the excellent quality of the supplemental materials available to adopters. These include an instructor's manual, a much improved solutions manual, student check-figures, a study guide, an extensive set of transparencies, and a personal-computer-based test generator.

Several notable improvements have been made for this edition. These include the strengthening of the sections on product costing and responsibility accounting, and divisional performance measurement. These topics now are presented in the same orderly, easy-to-follow manner as the remainder of the text. My classroom experience is that student understanding of these complex ideas has improved dramatically with the adoption of this newest edition.

This text presents a clearly written, well organized, user-oriented approach to the problems of management and the contribution that the accounting information system can make in solving these problems. Its orientation makes it particularly suitable for an undergraduate service course for business and non-business majors. It should be given serious consideration as the principal text for an introductory management accounting course.

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DEREK FRENCH, *Dictionary of Accounting Terms* (London: The Institute of Chartered Accountants in England and Wales, 1985, pp. xii, 300, £12.95).

This dictionary of over 3,400 accounting terms fills a useful niche in the reference material available to accountants of the U.K. and other nations who read British publications.

It is unique in pointing out differences in terms and their use between the U.K. and the U.S. Of particular interest to non-U.K. accountants are abbreviations and terms that are so commonly used in the U.K. that they may not be identified in pieces written largely for British readers.

This volume would be a useful addition to any accounting collection or library.

H.S.H.

RAY H. GARRISON, *Managerial Accounting: Concepts for Planning, Control, Decision Making*, Fourth Edition (Plano, Business Publications, Inc., 1985, pp. xvii, 814, $32.95).

This revision of a widely used text in managerial accounting continues the strength of the three previous editions. The author states that his objective in the fourth edition is to make it "the most teachable book of its kind" (p. vi). Whether Professor Garrison has succeeded is open to debate, but his writing style and management decision approach certainly provide strong reasons for considering the book in an introductory course.

The third edition (reviewed January 1983, p. 191) was concisely written and emphasized the management uses of accounting data rather than the accumulation of costs and preparation of statements. With the exception of Chapter 4 (process costing), the fourth edition is little changed in either the content or style of the chapter material. The end of chapter materials, however, received substantial revision. This material now is complete for differing levels of difficulty, but as in previous editions, often emphasizes procedures to a much greater degree than in the body of the chapter.

The support package accompanying this fourth edition includes items accompanying most competing texts (workpapers, solutions manual, student study guide, test bank) and one unique addition. Adopters of the fourth edition receive the COMPUTEST Microcomputer Testing System. This package allows the instructor to assemble tests from a test bank in two ways: (1) choose questions from the accompanying printout by number or (2) let the computer choose questions for the test. If the second option is chosen, the instructor may specify the type of questions (true-false, multiple choice, or essay) and the degree of difficulty (easy, medium, or hard) from any number of chapters. COMPUTEST also includes a program to maintain test scores for several classes of up to 250 students each.

In summary, although the changes were not too substantial, the fourth edition of this text is a solid candidate for adoption consideration. It is very well written with a large amount of new end-of-chapter material and good support packages. It continues to emphasize management decision making and thus is especially relevant to courses primarily designed for introductory business majors who may (or may not) continue in accounting.

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AKIRA ISHIKAWA, *Strategic Budgeting: A Comparison Between U.S. and Japanese Companies* (New York: Praeger, 1985, pp. xi, 225, $31.95).

Despite the book's title, the author's objectives, as stated in the preface, do not include a comparison of U.S. and Japanese companies. The preface provides the more accurate signal of things to come, as the book does not compare U.S. and Japanese approaches to strategic budgeting, or anything else. Thus the title of the book is baffling.

The book actually argues for the importance of strategic planning and the need to convert strategic plans into a specific strategic budget. Most of it discusses approaches and provides forms (Tables and Figures occupy 93 pages) for implementing a strategic budget. Almost all of the forms bear the footnote: "Source: Prepared by author." Not indicated is whether the forms have been found to be useful in an actual application. Most of them use data for a case titled ABC International, which the author says is an adaptation of a real case. But it is not clear whether these forms were used by that firm, or were just filled in with the firm's data.

Two other cases appear in Chapter 7. The first describes Canon, Incorporated's approach to strategic planning and budgeting. The second is a hypothetical case reprinted from another source. The latter, unfortunately, reads as if it is an advertisement for a particular group's professional consulting services.

The final chapter includes a discussion of the problems of world hunger and the build-up of nuclear weapons arsenals, in terms of strategic budgeting. The solution provided by the author may be of interest to some activists, but most policymakers would prefer a more rigorous analysis.

Those looking for a discussion of Japanese budgeting methods *vis-a-vis* the U.S. will need to look elsewhere. Major beneficiaries of the book are likely to be practitioners involved in the actual preparation of a strategic budget, for whom the author's various forms might provide some useful guidance.

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WALTER B. MEIGS, O. RAY WHITTINGTON, and ROBERT F. MEIGS, *Principles of Auditing*, Eighth Edition (Homewood: Richard D. Irwin, Inc., 1985, pp. xvii, 704, $35.95).

The eighth edition of *Principles of Auditing* continues to provide a wealth of theoretical and practical information on the independent auditors' attest function. While the authors retain the same objectives and conceptual approach as noted in the preceding edition (reviewed October 1982, pp. 841–842), this revised edition exposes students to current auditing philosophy and techniques. It reflects a major updating of the changes in professional auditing pronouncements, the auditors' legal liability, and computer-assisted auditing techniques.

Although the new edition contains the same number of chapters (19) as the seventh edition, the authors introduce the topic of auditors' reports in Chapter 2 as opposed to Chapter 18 in the preceding edition. This particular rearrangement is appropriate since the standards of reporting are introduced in Chapter 1. Thus the authors provide the reader with a basis for continuity and reinforcement rather than deferring the topic to Chapter 18. In addition, this adjustment facilitates the professor's presentation of auditors' reports.

This edition retains the same basic pedagogical features as the preceding edition with seven new research and discussion cases relative to auditors' reports, professional ethics, legal liability of auditors, planning the audit, internal control, evidential matter, and special audit engagements. Instructional aids include a solutions manual, instructor's lecture guide and test bank, and student study guide. The lecture guide contains transparencies for illustrating and summarizing important concepts and topics. The authors might consider an annotated bibliography for the instructor's guide. This would help students with their research of case studies.

The text is well written and each chapter is easily digestible. The authors continue to provide presentations of flowcharts and graphical illustrations that visually summarize key points.

In sum, the eighth edition is the text for professors who wish to guide students to careers in the accounting profession and prepare them for rigorous professional certification exams. It is well designed for a one-semester undergraduate or graduate auditing course.

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Daniel Oran and Jay M. Shafritz, *The MBA's Dictionary* (Reston: Reston Publishing Co., Inc., 1983, pp. vii, 431, $26.95 cloth, $15.95 paper).

This dictionary has about 4,000 entries that include terms, processes, persons, organizations, laws, and court cases in most or all of the accounting, business, and business-related fields including public and nonprofit administration. It would be an excellent reference source for students, teachers, and school and university libraries.

H.S.H.

Lee J. Seidler and Stewart Karlinsky, *Everything You Wanted to Know About Tax Shelters But Were Afraid to Ask*, Second Edition (New York: John Wiley & Sons, 1985, pp. xii, 106, $11.95 paper).

This book is an outgrowth of Professor Seidler's other vocation—general partner in the investment firm of Bear, Stearns & Co. The prior (1981) edition (not reviewed in The Review) was published by that firm. The stated objectives of the book are to inform the reader how to (1) evaluate and select a tax-favored investment, (2) minimize tax risks, and (3) compare a tax shelter with any other investment. The early chapters offer practical advice about tax shelters (such questions as "How the Internal Revenue Service Looks at Tax Shelters" and "How to Read the Offering Memorandum"). The later chapters discuss specific types of tax shelters such as real estate, equipment leasing, and oil and gas. Throughout, the emphasis is on practical advice.

For the time being, this book is up-to-date. It incorporates relevant parts from recent legislation and discusses the impact of current reform proposals on tax shelters. A particularly appealing section is the discussion of tax risk (the possibility that tax savings will not materialize), as distinct from investment risk. Advice abounds in the early chapters and is easy to follow. For example, the investor is advised to look elsewhere unless the accountant's report indicates that a forecast has been reviewed and guidelines are given for interpreting the tax counsel's opinion. Illustrative examples are used in the chapters dealing with equipment leasing and real estate tax shelters. Although these examples are easy to follow, an understanding of present values and internal rates of return is helpful. The chapters dealing with oil and gas, alternative energy, and R & D tax shelters adopt a more critical attitude, befitting the inherently higher risk in these offerings.

Seidler and Karlinsky have achieved their stated alternatives admirably. They give the sort of practical advice that most investors want. Their discussions are compact, without being too simplified. They have written at a level which is easily accessible, but never patronizing.

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SOFTWARE SUMMARIES

Harvey S. Hendrickson, Editor

Kermit: A File-Transfer Protocol, 1985 Version (New York: Columbia University Center for Computing Activities, $100 Tape A for Microcomputers, $100 Tape B for Mainframes, no charge for copies made by tape purchaser).

Kermit is a system for expanding the usefulness of personal computers (PCs), by enabling them to (1) function as terminals to connect with mainframes and (2) transfer information between the mainframe and the PC. This system is of interest to readers of THE ACCOUNTING REVIEW for several reasons. First, with Kermit no one needs both a PC and a terminal; the PC can continue to be used for stand-alone processing as necessary and in addition also can be used as a terminal. Second, materials developed on the PC, such as memos and other documents, can be transferred to the mainframe for use with the mainframe's facilities, such as electronic mail. As an example, a review such as this one can be composed on the PC, transferred to the mainframe, sent via Bitnet to any user at any one of 400 universities around the world which are currently connected, and then read by that user on his or her terminal (which itself could be a PC). Third, materials developed on the mainframe, such as the output from large-scale statistical processing, can then be transferred to the PC for use with the PC's facilities, such as interactive graphics or word processing. As an example, the output from an SAS statistical procedure could be transferred to the PC for inclusion in an article being developed on the PC.

The name Kermit is used for several programs and facilities. The first Kermit is a PC program which performs the terminal emulation. This program makes the PC "talk" to the mainframe like a terminal, usually like a DEC VT-52 or a DEC VT-100. Since the VT-52 and VT-100 are the closest things to a standard (in essence, a lowest common denominator) in this area, this means the PC can then connect with almost any mainframe. The second Kermit is a mainframe program to work with the PC Kermit to transfer files between the two computers. The third Kermit is a protocol for file transfer. This file transfer protocol is necessary because the connection between computers always is error-prone. The data to be transferred between computers then is sent with control information, so that the sending Kermit and the receiving Kermit can check to make sure that the data have been transferred correctly. Importantly, regardless of the type of computer functioning as the sending computer, the same Kermit on the receiving computer works without adjustment, and vice-versa.

The more technically oriented reader will find several more subtle but still important characteristics of the Kermit system. First, it is possible to use PC Kermit to transfer files between two PCs, though this is a somewhat tedious process. Also, Kermit can exist in two modes, server and nonserver. If the remote Kermit is in server mode, the user can make a string of requests from the local computer, such as transfers of several different files. In nonserver mode, each file transfer request must be made at both the remote computer and the local computer. In addition, any PC program can use the Kermit file protocol, not just the PC Kermit program itself. (Crosstalk is an example of a PC program which incorporates the Kermit protocol, since many mainframes now support it.) Finally, for some PC versions, the Kermit program allows the total redefinition of the keys on the PC keyboard; this is especially important in using the PC as a terminal in an IBM environment because of the importance of function keys.

Originally, Kermit was developed by the Columbia University Center for Computing Activities. Now, users develop extensions and send them to Columbia. All changes are made to develop a new version of Kermit, and the new version then is sent out by Columbia. At first, Kermit was developed for the IBM PC and DEC-20 mainframe, but Kermit has become so popular that it is now available for virtually every PC and mainframe. As an example of user support, in the fall of 1985 Kermit did not support the IBM 7171 protocol converter on the IBM operating system MUSIC, a very popular operating system at universities. (The 7171 is IBM's way of having an ASCII, asynchronous device such as a PC communicate with an EBCDIC mainframe.) But this combination of MUSIC and the 7171 was the one at Tulane. As a result, the Tulane Computer Services staff made the necessary changes and sent the modified program to Columbia for use at other universities with a similar configuration.

Kermit in all its variations is an excellent product, something every university should have. However, Kermit is not perfect and could be improved substantially both in terminal emulation and file transfer.

In the area of terminal emulation, PC Kermit does not have the capability to control a modem and dial the phone number of another computer, a capability which is often required, especially from home. This requires that the modem user must make the connection to the mainframe through some other means, such as manually dialing with some modems or using another program to make the connection. Also, Kermit does not have script files or something similar to automate regular log-on procedures or perform standard steps on the mainframe, such as checking memos or running particular programs. Further, PC Kermit does not support color, even if it runs on a PC with a color monitor.

For file transfer between PCs and the IBM mainframe, Kermit seems to have problems at high speeds (9,600 baud and up) and with large record lengths (240 bytes and up)—many errors are experienced in file transmission. This is a problem in accounting because a spreadsheet printed to disk often is 240 bytes in length, the maximum Lotus 1-2-3 prints. Further, the Kermit server does not work on all IBM mainframe operating systems, such as MUSIC, though it does work with CMS. Finally, with the IBM mainframe on either MUSIC or CMS, Kermit does not transfer binary files, such as program files and spreadsheet files from 1-2-3; it will only transfer ASCII text files. The Kermit server and transfer of binary files do work very well with the DEC-20 version of Kermit, however.

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EDITOR'S NOTE: Readers interested in learning more about Kermit should do the following before attempting to telephone the small staff of the Columbia University Center:

- Contact the computer services unit of your university, college, or other organization since it already may be a Kermit subscriber.
- Read the two-part article, "Kermit: A File-Transfer Protocol for Universities. . . ," by Frank da Cruz and Bill Catchings that appeared in *Byte* (June 1984, pp. 255–278 and July 1984, pp. 143–145, 400–403).
- Request the Kermit information package by writing to:

Kermit Distribution
Columbia University Center for
Computing Activities
7th Floor, Watson Library
612 West 115 Street
New York, NY 10025

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The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The REVIEW *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 33583. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $100 per insertion. Ads should not exceed 100 words.*

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#202 UNIVERSITY OF MISSOURI—ST. LOUIS has tenure-track positions; rank and salary dependent on qualifications. Most interest areas can be accommodated though candidates in financial, managerial, governmental or systems preferred. Quality research and teaching expected. Candidates should possess Ph.D./DBA. Professional certification desirable. ABDs considered for junior position. Senior appointment requires strong publication record. UMSL enrolls over 3,000 students in AACSB-accredited undergraduate and masters business programs. Pleasant suburban location. Submit resumé or inquiries to David R. Ganz, Coordinator, Accounting Area, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121 (an affirmative action, equal opportunity institution).

#203 ENDOWED CHAIR—THE DEPARTMENT OF ACCOUNTING AT TEXAS CHRISTIAN UNIVERSITY is seeking to fill the Robert and Maria Lowdon Chair of Business Administration. Candidates should have a distinguished record of scholarly research and high quality teaching. A visiting appointment can be considered. TCU is a well-endowed, private university of approximately 7,000 students. Salary, fringe benefits, and teaching load are competitive. Research support is excellent. Applications will be accepted until the position is filled. They should be sent to: Edward A. Johnson, Dean, M. J. Neeley School of Business, Texas Christian University, Fort Worth, Texas 76129. TCU is an Equal Opportunity/Affirmative Action Employer.

#204 TEXAS CHRISTIAN UNIVERSITY is seeking to fill several accounting positions at all Professorial levels and at the Instructor level. Visiting appointments can be considered. The professorial positions require a Ph.D. degree, with the senior level requiring a substantial record of academic research. Instructors must hold a Masters degree. TCU is a well-endowed, private university of approximately 7,000 students. Applications will be accepted until the positions are filled. They should be sent to: Donald R. Nichols, Chairman, M. J. Neeley School of Business, Texas Christian University, Fort Worth, Texas 76129. TCU is an Equal Opportunity/Affirmative Action Employer.

#205 THE UNIVERSITY OF EVANSVILLE invites applications for an Assistant/Associate Professor of Accounting in the areas of auditing, accounting theory, or cost accounting. The candidate is not expected to teach in all three areas. The University of Evansville is a small private institution. Excellence in classroom teaching is expected, along with a reasonable, complementary research focus. Please send a vita to Dr. Dale Hockstra, Dean, School of Business Administration, University of Evansville, 1800 Lincoln Avenue, Evansville, IN 47714 or call 812-479-2853.

#206 THE UNIVERSITY OF MICHIGAN—FLINT, School of Management invites applications for a permanent tenure-track faculty position in ACCOUNTING. Rank is dependent upon qualifications. Salary and benefits very competitive. Teaching in both BBA and MBA Programs. Ph.D./DBA with CPA/CMA preferred. ABD required. To teach management accounting/financial accounting/management information systems. Position available September 1986 or January 1987. UM-Flint is a non-discriminatory, affirmative action employer. Send resumé to Dean Richard W. Fortner, School of Management, The University of Michigan-Flint, Flint, Michigan 48503 or call (313) 762-3164.

#207 TEMPLE UNIVERSITY seeks applicants for accounting faculty positions. Rank is dependent on candidate's qualifications. Salaries are competitive, fringe benefits are excellent. Candidates should hold a doctorate in accounting or ABD with substantial progress toward completion. CPA or CMA is a plus. The Department desires well-balanced performance by its faculty, including teaching excellence, publications and service. BBA, MBA, MS in Tax, and Ph.D. programs are offered. Temple University is located in historic Philadelphia and is a short drive from the Pocono Mountains and the Jersey shore. Apply to: Dr. Stephen L. Fogg, Chairman, Department of Accounting, School of Business Administration, Temple University, Philadelphia, PA 19122. Telephone (215) 787-1915. Temple University is an equal opportunity, affirmative action employer. Qualified minorities and women are encouraged to apply.

#208 IDAHO STATE UNIVERSITY has two tenure-track positions at the Assistant/Associate rank to teach accounting at the graduate and undergraduate levels. Ph.D. in Accounting is preferred, but advanced ABDs will be considered. Relevant professional accounting experience plus CPA and/or CMA preferred. Starting date is August 29, 1986. Send application, vitae, official transcripts and three current letters of recommendation to Dr. Kermit O. Cudd, Dean, College of Business, Idaho State University, Pocatello, ID 83209. Positions are open until filled. Salary is competitive. Idaho State University is an Affirmative Action/Equal Opportunity Employer and encourages applications from minorities and women.

#209 DUKE UNIVERSITY—The Fuqua School of Business is seeking highly qualified faculty members in accounting. The qualifications required for these positions are a demonstrated interest in and capacity to do publishable research and a high level of competence in classes for MBAs and Ph.D.s. A Ph.D. degree is required. Rank and salary depend upon qualifications. Send resumé and list of references to Prof. David A. Dittman, Fuqua School of Business, Duke University, Durham, NC 27706. Duke University is an Affirmative Action/Equal Opportunity Employer.

#210 UNIVERSITY OF BALTIMORE invites applications for tenure-track positions in accounting. Teaching excellence is stressed; research experience and professional activities required. Applicant must possess the doctorate or equivalent (Ph.D., DBA, LLM/CPA). The University of Baltimore is an upper division, AACSB-accredited institution at the Junior, Senior, and Master levels (Masters of Taxation and Masters of Accounting). Forward your resumé to Dr. Charles L. Martin, Jr., CPA, Accounting Department, University of Baltimore, 1401 North Charles Street, Baltimore, Maryland 21201. The University of Baltimore is an Equal Opportunity, Affirmative Action Employer.

#211 SUFFOLK UNIVERSITY, Boston, Massachusetts. The School of Management's Accounting Department anticipates tenure-track openings at the assistant/associate professor levels to teach undergraduate/graduate courses in managerial and/or financial accounting. Ph.D. or DBA required. ABDs in final stage considered. Evidence of teaching and research competence required. Professional certifications desirable. Apply to: Ronald Sundberg, Associate Dean, School of Management, Suffolk University, 8 Ashburton Place, Beacon Hill, Boston, MA 02108 or call (617) 723-4700, ext. 307. An equal opportunity, affirmative action employer.

#212 THREE ASSISTANT PROFESSORSHIPS, tenure-leading, available August 1986. Will teach, do research and provide service in accounting. Requires Ph.D. or DBA. CPA or CMA desirable. Apply with vita and names of three references to Dr. Tom Balke, Search Chair, School of Accountancy, College of Business Administration, University of Nebraska-Lincoln, 137 CBA, Lincoln, Nebraska 68588-0488. Affirmative Action/Equal Opportunity Employer.

#213 UNIVERSITY OF NEW ORLEANS invites applications for the position of Assistant or Associate Professor of Accounting. Candidates should have the Ph.D. or DBA degree. Evidence of excellence in teaching, research, and professional activities is necessary. Salary is negotiable and competitive. The University offers the M.S. in Accounting and the M.S. in Accounting (tax option), as well as the M.B.A. Approximately 700 undergraduate accounting majors are enrolled. The University has AACSB accreditation at both the undergraduate and graduate levels. Candidates should send resumé to Professor R. J. Thacker, Chairman, Department of Accounting, College of Business Administration, University of New Orleans, New Orleans, LA 70148. UNO is an Affirmative Action, Equal Opportunity Employer.

#214 GEORGE WASHINGTON UNIVERSITY, Department of Accountancy invites applications for tenure-track positions in accounting. Candidates are expected to possess a doctoral degree or be near completion of degree, and should be dedicated to teaching excellence and research. GWU is an equal opportunity, affirmative action employer. Please send vita to Professor Michael Gallagher, Chairman, Department of Accountancy, George Washington University, 710 21st Street, NW, Room 209, Washington, DC 20052. Telephone (202) 676-6825.

#215 THE UNIVERSITY OF MARYLAND European and Asian Divisions seek excellent teachers for undergraduate courses on U.S. military bases overseas. Minimum requirements include a master's in accounting, one year of recent college teaching experience, and U.S. citizenship. Renewable annual appointments begin August 1986. Excellent for a sabbatical or leave of absence. Benefits include transportation, a currency adjustment allowance, and military base privileges. Frequent travel and the cost of schooling make these positions difficult for those with children. Send resumé to Dr. Lois A. Mohr, The University of Maryland University College, College Park, MD 20742. AA/EOE.

#216 THE UNIVERSITY OF GEORGIA, J. M. Tull School of Accounting, is seeking qualified applications for a tenure-track faculty position beginning September 1987. Candidates are expected to possess a doctoral degree or be near completion of degree. Candidates should be dedicated to teaching excellence and research. Resumés should be sent to Floyd W. Windal, Director, J. M. Tull School of Accounting, College of Business Administration, University of Georgia, Athens, GA 30602. The University of Georgia is an Equal Opportunity/Affirmative Action Employer.

#217 INDIANA UNIVERSITY OF PENNSYLVANIA invites applications for eight tenure-track positions in the Accounting Department, College of Business, beginning the Fall semester 1986. Qualifications are Ph.D. or DBA or candidate actively pursuing the doctorate. Candidates holding the masters degree with a strong background in accounting and professional certification (CPA and/or CMA) will be considered for a temporary appointment. Doctorally qualified candidates with a strong record of publications and scholarly activity may qualify for a teaching workload reduction. Salary is competitive, plus excellent fringe benefits. Send letter of application along with resumé, transcripts and three letters of reference to: Dr. Dennis D. Tiger, Chairperson, Faculty Selection Committee, Department of Accounting, Indiana University of Pennsylvania, Indiana, PA 15705. Initial screening will begin on January 15, 1986. Applications will be accepted until positions are filled. IUP is an affirmative action/equal opportunity employer.

#218 EASTERN MICHIGAN UNIVERSITY is seeking faculty members in accounting to fill tenure-track positions. Rank is dependent upon qualifications. Salary and benefits are competitive. Teaching at the undergraduate and masters levels, participating in student affairs, research and writing, and professional development. Ph.D./DBA is preferred. ABD or masters degree with a professional certification will be considered. Eastern Michigan is an affirmative action employer. Send resumé to Keith W. Lantz, Head, Department of Accounting and Finance, Eastern Michigan University, Ypsilanti, MI 48197, or call (313) 487-3320. An affirmative action/equal opportunity employer and educational institution.

#219 APPLICATIONS ARE INVITED for candidates with Ph.D./DBA plus CPA; tenure-track positions available September 1986 in the areas of Auditing, Accounting Theory, Computer Applications, Intermediate Accounting. ABDs in final dissertation stage will be considered. Teaching experience is preferred. Candidate must have commitment to research. Northeastern Illinois University is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply. All positions Assistant or Associate Professor. Selection process begins January 13, 1986 and continues until position is filled. Direct resumé, transcripts and letters of reference to: Dr. Olga E. Englehardt, Dean, College of Business and Management, Northeastern Illinois University, 5500 N. St. Louis, Chicago, IL 60625.

#220 VALPARAISO UNIVERSITY—ACCOUNTING 1986–87. Full-time, tenure-track positions available August 1986 at private, Lutheran-related University in northwest Indiana. Ph.D. or DBA required for Associate or Full Professor. CPA or CMA desirable. Research and publication required. Summer research funds available. Salary—AACSB competitive. Apply to Dr. F. Barry Haber, CBA, Valparaiso University, Valparaiso, Indiana 46383. (219) 464-5040.

#221 THE UNIVERSITY OF NEVADA, LAS VEGAS is seeking faculty at all ranks, especially to teach auditing. Applicants should have an earned doctorate or be ABD near completion. Applicants for senior rank should have a record of performance in teaching and research. Send resumé and copies of recent teaching evaluations to: Chair, Department of Accounting, College of Business and Economics, University of Nevada, Las Vegas, Nevada 89154. Review of applicants will begin on December 31, 1985 and continue until all positions are filled. We are an Equal Opportunity/ Affirmative Action Employer and minority candidates are encouraged to apply.

#222 THE UNIVERSITY OF MANITOBA is seeking applicants for tenure-track positions in accounting for July 1986. Rank is open, based on qualifications and experience. A visiting appointment is also possible. Ph.D. or DBA, completed or near completion, is required. Duties include research and teaching at the undergraduate and graduate levels. Salary is competitive and will depend on qualifications, experience, and research record. Winnipeg, a multicultural city of 600,000, offers the best of an urban environment in the heart of Canada's vacation land. Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to qualified Canadian citizens and permanent residents of Canada. Applications should be sent to: Dr. L. I. Gould, Head, Department of Accounting and Finance, University of Manitoba, Winnipeg, Manitoba R3T 2N2.

#223 THE DEPARTMENT OF ACCOUNTING AT CSUF invites candidates to apply for the newly established Ernst & Whinney Faculty Research Fellowship in Accounting. Requirements: National visibility as Accounting scholar with appropriate doctoral degree, evidence of high quality scholarship activity culminating in peer-reviewed publications, meaningful participation in professional accounting organizations at national and local levels, and ability to communicate accounting concepts effectively to students. Rank: Associate Professor or Professor. Send resumés and inquiries to: Dr. Trini U. Melcher, Chair, Department of Accounting, School of Business Administration & Economics, California State University-Fullerton, Fullerton, CA 92634. CSUF is an equal opportunity employer.

#224 SEEKING FULL-TIME TENURE-TRACK POSITION for Fall of 1986. Will receive DBA in accounting in May 1986. Geographic preference: small city in east (Maine to North Carolina) or southwest (Arizona, New Mexico, or Colorado).

#225 TEACHING POSITION AVAILABLE IN ACCOUNTING/FINANCE beginning in Fall 1986. Qualifications: MBA/CPA; should be able to teach both Accounting and Finance; consulting and/ or teaching experience desirable; commitment to effective teaching and liberal arts education. Send resumé, supporting documents, and at least three references to Don Henrickson, Director of Business Administration, St. Norbert College, DePere, WI 54115. St. Norbert College is an equal opportunity/affirmative action employer.

#226 ACCOUNTING FACULTY, Fall 1986. One tenure-track position and one limited-term position available to teach undergraduate MBA accounting courses. Earned doctorate preferred, Master's with CPA or CMA acceptable. Prior business experience essential. We seek candidates who are comfortable with and can contribute to the mission of a Catholic liberal arts college which is committed to the total development of the individual student. We emphasize high quality teaching and strong teacher/student relationship. Research or consulting is encouraged. Send resumé to: Frank Coglitore, College of St. Thomas, Department of Business Administration, 2115 Summit Avenue, St. Paul, Minnesota 55105.

#227 ACCOUNTING: Lock Haven University is searching for a dynamic teacher, productive scholar in accounting. Ph.D./D.B.A. in Business Administration with a major in Accounting preferred. Exceptionally well-qualified M.S./M.B.A. applicants with major in Accounting will be considered. Professional certification required for M.S./M.B.A. applicants. Information systems background desirable. Business, government and/or teaching experience required. Tenure-track at Instructor or Assistant Professor rank; competitive salary with excellent fringe benefits. Teach undergraduate courses in accounting. Other duties include curriculum development in a growing program, student advisement, and committee assignments. Lock Haven University is located in beautiful country, 30 miles northeast of Penn State University. One of 14 state universities, it is dedicated exclusively to excellence in undergraduate education and training. The University enrollment is over 2,600. Write Dr. Robert Seyfarth, Chair, Department of Computer Science, Management Science, and Accounting, Lock Haven University, Lock Haven, PA 17745. Include: Vita, with list of current research publications, evidence of teaching excellence, and names of three references. Lock Haven University is an equal opportunity employer.

#228 ACCOUNTING/TAXATION POSITION WANTED for Fall 1986 or Fall 1987—Juris Doctor, Masters of Accounting, C.P.A., eight years teaching experience at the undergraduate and graduate level, publications and consulting experience. Write for resumé and references.

#229 VISITING PROFESSOR or full-time person to fill a tenure-track opening. Start Fall 1986. Candidates should have appropriate doctorate (ABD will be considered). Teaching responsibilities include undergraduate and MBA accounting courses. Salary and rank open, commensurate with qualifications and experience. Georgia College, with 4,000 students, is 30 miles northeast of Macon and 95 miles southeast of Atlanta. The College is an equal opportunity, affirmative action employer. Send resumé to Dr. Eugene Shepard, Chairman; Department of Accounting, Georgia College, School of Business; Milledgeville, Georgia 31061.

#230 CHAIR POSITION. ST. CLOUD STATE UNIVERSITY is seeking a chairperson for the Department of Accounting as a tenure-track associate or full professor commencing Fall 1986. Candidates should have a doctorate in accounting with at least five years of university-level experience, and they should also have demonstrated teaching excellence, research capabilities, and the ability to work effectively with the business community. The chairperson is expected to provide leadership to a 12-member department offering a full range of courses in accounting including a B.S. degree, a Master of Science in Accounting degree, and an MBA degree. St. Cloud State is accredited by the AACSB at both the undergraduate and graduate levels. Administrative responsibilities include program development, faculty recruitment and evaluation, fund raising, student advising, and attracting employers to the university. Salary is competitive and will depend on credentials and experience. Interested parties should submit a resumé and letter of application to Dean James G. Marmas, College of Business, St. Cloud State University, St. Cloud, MN 56301 by April 14, 1986. The University is an Equal Opportunity/Affirmative Action Employer, and SCSU encourages women and minorities to apply.

#231 MCNEESE UNIVERSITY is seeking applicants for tenure-track positions in Accounting starting Fall 1986 or later. Rank and salary offered will be determined by qualifications. Doctorate in Accounting preferred but doctoral candidates in dissertation stage will be considered. A record of teaching experience and publication is required for appointments at higher ranks. McNeese University, located in Lake Charles, Louisiana, is a state-supported university. Interested persons should submit a resumé to Dr. Eldon R. Bailey, Head, Department of Accounting, McNeese State University, Lake Charles, Louisiana 70609. McNeese University is an Equal Opportunity/Affirmative Action Employer.

#232 TAXATION, THE UNIVERSITY OF TOLEDO. The Department of Accounting invites applications for a position in taxation effective September 1986 or January 1987. Candidates should possess a doctorate in Accounting, with taxation as a major area of study; ABD's will also be considered. Salary for the appointment is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The campus is located in an excellent neighborhood which enables many of the faculty to walk to their offices. The Accounting Department offers an undergraduate degree in Accounting, as well as a Master of Science in Accounting degree and the MBA. Send vita to: Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, OH 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

#233 ACCOUNTING FACULTY: Small, quality liberal arts college in S.E. Pennsylvania has full-time, permanent faculty vacancy commencing Fall 1986. Duties include teaching full range of undergraduate accounting courses (capability to teach other related courses a plus) and direct strong accounting program in liberal arts context. Prefer earned Ph.D. (holder or exceptionally well qualified ABD candidate). Rank/salary open and competitive. Prior teaching/CPA/CMA/work experience a plus. Send resumé/vita to Dr. Harold E. Dolenga, Head, Economics and Business Department, Muhlenberg College, Allentown, PA 18104 by April 15, 1986.

#234 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate and Full Professor positions for 1986–87. Tenure-track and one-year appointments are available. Tenure-track positions normally require a doctorate or ABD, except in taxation which requires a J.D. or MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's strongest needs are for persons who can teach taxation (undergraduate and graduate) or financial accounting. California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to Gary V. Jorden, Chair, Department of Accounting, California State University, Los Angeles, CA 90032.

#235 CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS (Los Angeles area) has an accounting tenure-track opening available September 1986. Tenure-track requires an earned doctorate, CMA or CPA desirable. CSUDH is located in the southwestern portion of the Los Angeles basin near major aviation, space, and commercial complexes. Salary/fringe benefits competitive. Applications will be accepted until position is filled. Send resumé to Dr. Donald J. Barnett, Chairperson, Department of Accounting/Law, CSUDH, Carson, California 90747, or telephone (213) 516-3556. CSUDH is an equal opportunity/affirmative action/Section 504/Title IX employer.

#236 POSITION WANTED: Endowed chair. JD, two Ph.D.'s, CPA, and other certifications, author of 21 books and monographs, more than 100 articles. Eleven years business experience, nine years teaching experience. Strongest in financial and tax accounting. Also competent in managerial accounting, principles of economics and history of economic thought. All locations considered.

#237 TAXATION/LAW POSITION WANTED for Fall 1986. Several years teaching tax and business law experience. Also four years Big Eight tax experience. Write for resumé.

#238 CALIFORNIA STATE UNIVERSITY, HAYWARD seeks applications for tenure-track faculty positions in accounting and management information systems beginning Fall 1986. Ph.D. (or ABD near completion) required. Assistant Professor positions in financial, managerial, cost, auditing, and management information systems. Senior level positions in managerial and cost. June 1, 1986 salary ranges for nine months: Assistant Professor—$29,484 to $35,460; Associate Professor—$33,780 to $40,704; Full Professor—$41,520 to $50,100. Teaching assignments will include instruction at the undergraduate and/or graduate levels in a department that has an excellent reputation. Hayward, located across the bay from San Francisco, has attractive residential areas. There are ample opportunities for research and consulting with business and other entities in this diversified metropolitan community. Qualified candidates should send letters of application and resumés to Wade A. Morehouse, Chair, Department of Accounting, California State University, Hayward, Hayward, California 94542. An affirmative action, equal opportunity employer.

#239 WAYNE STATE UNIVERSITY invites applications for Chairperson of the Department of Accounting. The Department consists of 33 faculty teaching a variety of courses including Accounting, Law, and Systems; it has strong support from CPA firms and industries. The School has 2,900 undergraduates and 900 MBA students and is accredited by AACSB. Applicants should have an earned doctorate and a demonstrated record of instruction, publication, and administration for tenure at the rank of Associate or Full Professor. Send inquiries and vita to: Dr. David Gabhart, Chair, Accounting Chairperson Search Committee, School of Business Administration, Wayne State University, Detroit, Michigan 48202; (313) 577-4530. An affirmative action/equal opportunity employer.

#240 The Department of Accounting, WAYNE STATE UNIVERSITY, invites applications for tenure-track positions as Assistant or Associate Professor to teach undergraduate classes in Auditing or Managerial Accounting; conduct scholarly research, and provide other services consistent with the goals of the School of Business Administration. Qualifications include an earned doctorate in accounting (those nearing completion of doctoral dissertation will be considered), research potential, and a demonstrated record of excellence in instruction. Inquiries and vita should be sent to: Dr. David Gabhart, Wayne State University, School of Business Administration, Detroit, Michigan 48202; (313) 577-4530. An affirmative action/equal opportunity employer.

#241 POSITION WANTED: Ph.D. in Accountancy; 25 years of teaching experience; modest publications; desire position to teach mainly management/cost accounting in an AACSB school with commitment to excellence in teaching.

#242 POSITION WANTED. Active scholar in accounting history and business and professional ethics seeks research-oriented academic appointment. Doctorates in accounting and philosophy. Several major scholarly publications, including (by midsummer) two long books. Development of a variety of innovative courses in financial and managerial accounting and applied ethics. Accounting interests slanted toward historical, behavioral, and cultural interpretation. Available fall 1986. Visiting professorship would be considered.

#243 THE UNIVERSITY OF NEBRASKA AT OMAHA invites applications and nominations for the Department of Professional Accounting Chairperson beginning fall 1986. Applicants must possess an earned doctorate and must have evidence of a strong post-doctoral record of teaching, scholarly research and publication, and professional activities appropriate for an appointment at the Associate or Full Professor rank. This announcement will remain open until the position is filled. Nominations and applications should be sent to: Dr. Larry Trussell, Dean, College of Business Administration, University of Nebraska at Omaha, Omaha, Nebraska 68182-0048. An Equal Opportunity, Affirmative Action Employer.

#244 THE UNIVERSITY OF BALTIMORE invites applications for the position of Chairperson, Department of Accounting in the School of Business. Position requires Ph.D. or D.B.A. plus publications, administrative skills, and outstanding teaching experience. C.P.A., C.M.A. or C.I.A. also preferred. The salary is competitive. Apply during April or until the position is filled. Contact Dr. Arthur Roberts, Accounting Department, University of Baltimore, 1420 North Charles Street, Baltimore, Maryland 21201. An affirmative action, equal opportunity employer.

#245 WIDENER UNIVERSITY has September 1986 opening for tenure-track accounting faculty member. Ph.D. preferred but will consider one with substantial progress toward Ph.D. Rank and compensation will depend on education and experience. Areas of interest are financial and managerial accounting and accounting information systems. The Accounting Department has eight full-time members. The normal semester course load is 12 credits (9 undergraduate, 3 graduate), with two or three preparations. Widener University, conveniently located near Philadelphia and Wilmington, Delaware, offers B.S. and M.S. degrees in accounting and an MBA program. Write to Professor Martin Gage, Chairman, Accounting Department, Widener University, Chester, PA 19013.

#246 NEW ZEALAND—UNIVERSITY OF CANTERBURY. The Council of the University invites applications for appointment to a Chair or Readership in Accountancy. The successful candidate will have demonstrated academic leadership and possess a record of outstanding research in one or more of the areas of Financial Accounting, Management Accounting, Business Finance, or Taxation. At present the salary for a Professor is within the range of $NZ62,000 to $NZ77,500 per annum and for a Reader is within the range of $NZ53,000 to $NZ59,000 per annum. The commencing or subsequent salary may be increased as a result of the review of salaries which the University makes at the beginning of each year. Applications close on May 30, 1986. Further particulars and Conditions of Appointment may be obtained from: W. Hansen, Registrar, University of Canterbury, Private Bag, Christchurch, New Zealand.

#247 CENTENARY COLLEGE OF LOUISIANA is seeking applications for a tenure-track position in accounting for August 1986. Doctorate is desirable; however, candidates with an MPA degree with CPA or CMS and a strong commitment to excellent teaching will be considered. Centenary is a liberal arts institution related to the United Methodist Church, offering undergraduate and master's degrees in business with an undergraduate major in accounting. Please send resumé, transcripts, and letters of recommendation to Dr. Barrie Richardson, Dean, School of Business, Centenary College of Louisiana, P.O. Box 41188, Shreveport, Louisiana 71134-1188. An Affirmative Action, Equal Opportunity Employer.

#248 ASSOCIATE/ASSISTANT PROFESSOR OF ACCOUNTING. Two tenure-track positions available August 1986. Teaching various undergraduate and master level courses. Some research required. Prefer terminal degree in field, but ABD's near completion will be considered. Salary is competitive. Excellent living conditions in small city setting. Send resumé, transcripts, and three letters of reference to Professor W. J. Radig, Acting Chairman, Department of Accounting, Marshall University, Huntington, West Virginia 25701. Application deadline: May 15, 1986 or until positions are filled. Marshall University is an Equal Opportunity/Affirmative Action Employer.

#249 CALIFORNIA POLYTECHNIC STATE UNIVERSITY—SAN LUIS OBISPO seeks candidates for Fall 1986 appointments in tenure-track faculty positions in accounting with primary teaching interests in managerial/cost and financial accounting. Doctorate with major in accounting required. Practical experience and professional certification preferred. Candidates must be committed to teaching excellence and professional development including research, publication, and professional service. Teaching responsibilities include the undergraduate and MBA programs. Rank and salary commensurate with experience. Fourteen-member accounting faculty; 400 outstanding students from top five percent of California high school graduates; small class sizes. Approximately 75 percent of graduates go into public accounting. Scenic central coast offers outstanding climate year-round with close proximity to beaches, mountains, and wine country. Half day's travel to L.A., San Francisco, and Sierras. Contact Dr. William C. Boynton, Accounting Department Head, School of Business, California Polytechnic State University, San Luis Obispo, CA 93407. Cal Poly is an equal opportunity/affirmative action employer.

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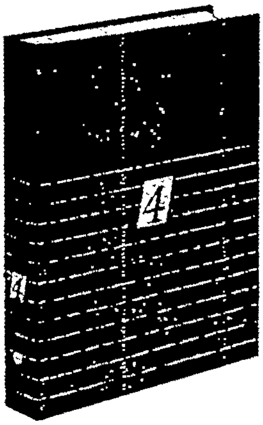

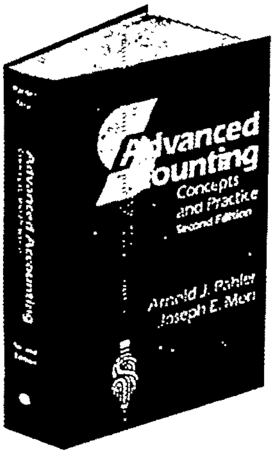

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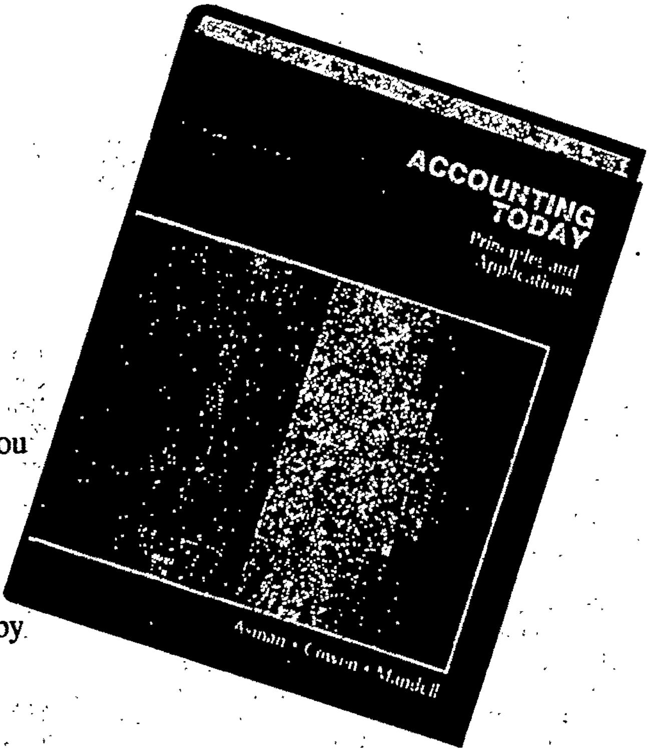

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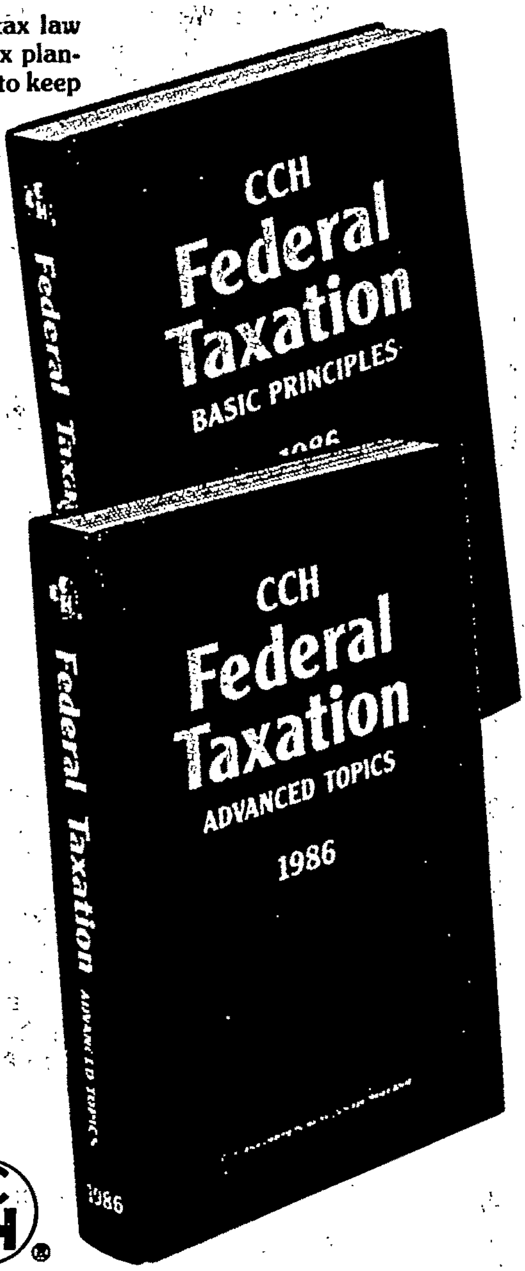

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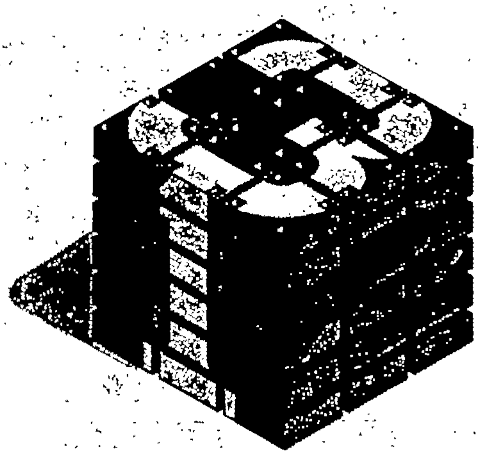

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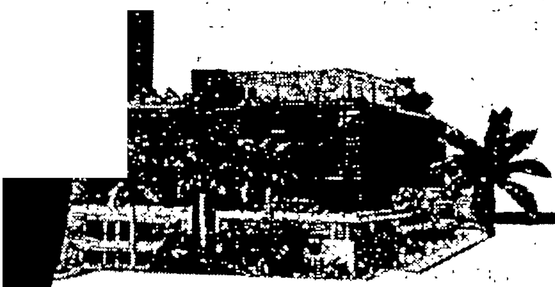

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